

# Journal of the Royal Society of Arts

NO. 4895

FRIDAY, 20TH MARCH, 1953

VOL. CI

## FORTHCOMING MEETINGS

TUESDAY, 24TH MARCH, AT 5.15 p.m. COMMONWEALTH SECTION. "*Making Films in and for the Colonies*", by W. Sellers, O.B.E., Producer and Head of the Colonial Film Unit. The Honble. Anthony Asquith will preside. (The paper will be illustrated with films. Tea will be served from 4.30 p.m.)

WEDNESDAY, 25TH MARCH, AT 2.30 p.m. "*The Collection of Folklore in England*", by Peter Opie. The Right Honble. Lord Raglan, F.S.A., Past-President, Folklore Society, will preside. (The paper will be illustrated with exhibits, lantern slides and recordings.)

FRIDAY, 27TH MARCH, AT 5.15 p.m. COMMONWEALTH SECTION. "*The Kitimat Hydro-Electric Power Development Scheme*", by F. L. Lawton, P.Eng., Fc.I.A.I.E.E., M.E.I.C., M.A.S.C.E., Chief Engineer, Power Department, Aluminium Laboratories, Ltd., Montreal. G. G. Crean, Counsellor, Canada House, will preside. The paper will be illustrated with lantern slides. (Tea will be served from 4.30 p.m.)

WEDNESDAY, 15TH APRIL, AT 2.30 p.m. "*Materials Handling and Processing—Past and Present*", by L. Landon Goodman, B.Sc., A.M.I.Mech.E., A.M.I.E.E., of the British Electrical Development Association. Lieut-General Sir Thomas Hutton, K.C.I.E., C.B., M.C., General Manager, British Productivity Council, will preside. (The paper will be illustrated with lantern slides.)

## PRESENTATION OF THE ALBERT MEDAL FOR 1952

His Royal Highness The Duke of Edinburgh, President of the Society, presented the Albert Medal for 1952 to Air Commodore Sir Frank Whittle, K.B.E., C.B., M.A., F.R.S., at Buckingham Palace on Wednesday, 4th March. This medal, as announced in the *Journal* of 11th July, 1952, was awarded to Sir Frank "for the development of the continuous-combustion gas turbine and jet propulsion".

The presentation, which was the first official act of His Royal Highness as President of the Society, was attended by the following Members of Council: Mr. E. Munro Runtz (Chairman of Council); Professor E. N. da C. Andrade; Mr. A. C. Bossom; Sir Frank Brown; Mr. Wells Coates; Sir Edward Crowe; Professor E. C. Dodds; Mr. P. A. Le Neve Foster; Captain L. G. Garbett; Mr. John Gloag; Sir Ernest Goodale; Mr. A. C. Hartley; Dame Caroline Haslett; Dr. R. W. Holland; Lord Horder; Sir William Ogg; The Earl of Radnor; Mr. J. W. Ramsbottom; Mr. E. M. Rich; Mr. A. R. N. Roberts; Mr. Gordon Russell; Sir Harold Saunders; Sir John Simonsen; Professor L. Dudley Stamp; Mr. William Will; Sir John Woodhead, and Miss Anna Zinkeisen; with Mr. K. W. Luckhurst (Secretary) and Mr. R. V. C. Cleveland-Stevens (Assistant Secretary).

After Members of the Council had been presented to His Royal Highness, The President addressed Sir Frank Whittle as follows:

Sir Frank Whittle,

This medal was instituted by the Society of Arts in 1864 as a memorial of the Presidency of my great-great-grandfather, Prince Albert, and it is awarded annually for "distinguished merit in promoting Arts, Manufactures and Commerce". Among the illustrious names of which the list of recipients is composed are those of Michael Faraday, William Siemens and Charles Parsons who, through the invention of the dynamo and electric motor and the steam turbine, contributed so much to the world's powers of production and speed of communication.

You have pioneered another prime mover of the greatest importance and with the most astonishing potentialities—the jet engine—and by its invention you not only made a vital contribution to the defence of your country in war but have enabled it since the war to become supreme in the field of high-speed flight.

On the recommendation of the Council of the Royal Society of Arts and also on my own behalf as President of the Society, I am most happy to present to you the Albert Medal which was awarded to you last year.

Sir Frank Whittle replied as follows:

I thank you, Sir, and, through Your Royal Highness, the Council of the Royal Society of Arts, for the very great honour they do me in awarding me the Albert Medal.

To have received this rare distinction from the hands of Your Royal Highness in person is a further very great honour, for which it is difficult adequately to express my gratitude and thanks. This is a very proud and memorable moment for me.

Both The Duke of Edinburgh and Sir Frank Whittle were in uniform; His Royal Highness was wearing the uniform of a Marshal of the Royal Air Force for the first time.

## THE ALBERT MEDAL FOR 1953

The Council are now considering the award of the Albert Medal of the Royal Society of Arts for 1953. They therefore invite Fellows of the Society to forward to the Secretary, by 8th April, the names of such men of high distinction as they may think worthy of this honour. The medal was struck to reward "distinguished merit in promoting Arts, Manufactures and Commerce". A list of previous recipients appeared in the last issue of the *Journal*.

## MEETING OF COUNCIL

A meeting of Council was held on Monday, 9th March, 1953. Present: Mr. E. Munro Runtz (in the Chair); Mr. F. H. Andrews; Mr. A. C. Bossom; Sir Frank Brown; Mr. Wells Coates; Sir Edward Crowe; Sir John Forsdyke; Mr. P. A. Le Neve Foster; Captain L. G. Garbett; Mr. John Gloag; Sir Ernest Goodale; Mr. A. C. Hartley; Dame Caroline Haslett; Dr. R. W. Holland; Lord Horder; Mr. G. K. Menzies; Mr. F. A. Mercer; Mr. J. A. Milne; Mr. O. P. Milne; Sir William Ogg; The Earl of Radnor; Mr. E. M. Rich; Mr. A. R. N. Roberts; Sir Harold Saunders; Sir Selwyn Selwyn-Clarke; Sir John Simonsen; Mr. William Will, and Sir John Woodhead; with Mr. K. W. Luckhurst (Secretary) and Mr. R. V. C. Cleveland-Stevens (Assistant Secretary).

## ELECTIONS

The following candidates were duly elected Fellows of the Society:

Armstrong, Mrs. Ethel Mary, London.  
 Briggs, Kenneth James, London.  
 Bryan, Charles W., Jnr., Chicago, Illinois, U.S.A.  
 Chopra, Bal Raj, Simla, India.  
 Davis, Arthur, Chesterfield, Derbyshire.  
 Guy, John William, Durban, South Africa.  
 Hallett, Laurence Edward, F.C.I.S., Orpington, Kent.  
 Houlker, Granville, Nelson, Lancs.  
 Jacob, Miss Rhoda Hannah, M.A., London.  
 Jupp, Edmund William, B.Sc., Georgetown, British Guiana.  
 La Ferla, Francis M. E., Malta, G.C.  
 Leach, Alexander, A.R.I.B.A., A.R.I.C.S., St. Annes-on-Sea, Lancs.  
 McGee, James Dwyer, O.B.E., M.Sc., Ph.D., A.M.I.E.E., London.  
 Millar, Archibald Galbraith, Rutherglen, Lanark.  
 Navanitakrishna, Professor T. P., M.A., Annamalainagar, S. India.  
 Officer, David Adrian, B.A., A.T.D., Melrose, Roxburgh.  
 Pittman, Albert, Khartoum, Sudan.  
 Pomeroy, Laurence Evelyn Wood, M.S.A.E., London.  
 Reid, John, A.R.I.B.A., London.  
 Ross, Miss Elsie, A.R.C.A., Woodford, Cheshire.  
 Sandford, Christopher, M.A., Leominster, Herefordshire.  
 Traverse-Healy, Thomas Hector, London.  
 Yeoman, Mrs. Antonia, London.

The following candidate was duly elected an Associate Member of the Society:

Cohen, Leonard, London.

The following School was admitted under Bye-Law 66:

The Greenford County Grammar School, Middlesex.

#### ALBERT MEDAL

Further consideration was given to the award of the Albert Medal for 1953.

#### THOMAS GRAY MEMORIAL TRUST

The recommendations of the Thomas Gray Memorial Trust Committee with regard to awards for 1952 were approved and the proposals for 1953 were adopted. (Details of these awards and offers are given below.)

#### R.D.I. JOINT COMMITTEE

The Council Members of the R.D.I. Joint Committee were re-appointed.

#### CHRISTMAS CARD

Consideration was given to the design of the Society's Christmas Card for 1953.

#### R.I.B.A. BOARD OF ARCHITECTURAL EDUCATION

Mr. A. C. Bossom, F.R.I.B.A., was re-appointed as the Society's representative on the R.I.B.A. Board of Architectural Education for 1953-54.

#### OTHER BUSINESS

A quantity of financial and other business was transacted.

### THOMAS GRAY MEMORIAL TRUST AWARDS

#### 1952 AWARDS

##### *Prize for an Essay*

The Council, on the recommendation of the Thomas Gray Memorial Trust Committee, has awarded the prize of £50 offered last year for an essay to First Officer J. W. Killan, of the R.M.S. *Ascania*.

The subject prescribed for the competition was, "The future development of the Cargo Liner, with particular reference to the following: general construction, tonnage, capacity, power unit, speed, general economy and complement".

The Council has also accepted the Committee's recommendation to award a second prize of £10 to Chief Officer I. S. McLean, of the m.v. *Ajana* for his essay, which was the second best of the seven submitted.

##### *Extra-Master's Silver Medal*

The Silver Medal offered by the Council under the Thomas Gray Memorial Trust to the candidate obtaining the highest marks in 1952 in the Ministry of



20TH MARCH 1953

JOURNAL OF THE ROYAL SOCIETY OF ARTS

Transport's Examination for the Extra-Master's Certificate has been awarded to Captain Andrew James Reginald Tyrrell, of Yorkshire.

*Deed of Professional Merit*

The prize of £50 offered in 1952 for a Deed of Professional Merit was not awarded as none of the submissions was considered sufficiently outstanding.

OFFERS OF AWARDS FOR 1953

*Prize for an Essay*

The Council offers a prize of £50 for an essay by a professional seafarer of the British Merchant Navy, of British nationality, who is serving afloat or, if now ashore, was last regularly serving afloat no longer ago than 1st January, 1951. The subject of the essay is:

The improvement of cargo handling appliances both on board ship and on the quayside; with special reference to the need for self-sufficient arrangements in times of emergency and the overriding consideration of keeping costs low.

The essay should not exceed 7,500 words in length, and should reach the Secretary not later than 31st December, 1953. It should be typed in English, and must be submitted under a pseudonym, accompanied by a sealed envelope enclosing the author's name and address which must on no account be written on the essay. A breach of this regulation will result in disqualification.

The Council reserves an option on the copyright of the successful essay.

*Prize for a Deed of Professional Merit*

In recognition of the remarkable skill which is so constantly displayed at sea the Council again offers a prize of £50 to a member of the British Merchant Navy for a deed brought to their notice which, in the opinion of the judges to be appointed by the Council, is of outstanding professional merit.

The period to be covered by this offer will be the year ending 30th September, 1953, and deeds of a character worthy to be considered for this offer may be brought to the notice of the Council by any person not later than 31st December, 1953. They will not, however, be considered by the judges unless they have been endorsed by a recognized authority or responsible person able to testify to the deed to be adjudged.

The Council reserves the right to withhold, reduce or divide either of the above awards at their discretion.

# BRITISH INLAND WATERWAYS TO-DAY AND TO-MORROW

*A paper by*

**ROBERT AICKMAN**

*Founder and Vice-President of The Inland Waterways  
Association, read to the Society, on Wednesday,  
18th February, 1953, with Sir Gilmour Jenkins,  
K.C.B., K.B.E., Permanent Secretary, Ministry  
of Transport, in the Chair*

THE CHAIRMAN: I have two tasks this afternoon. The first one is to apologize for being here at all. Unfortunately my Minister at the last moment was unable to come, and those of you who have been following Parliamentary matters in the last few weeks will scarcely be surprised that he was not able to manage it. So the task has fallen on me at rather short notice; in fact, you are scarcely more surprised to see me than I am to be here.

The second task is to introduce our speaker to-day, Mr. Aickman, who is well known in other spheres as an author and dramatic and film critic, and in this particular sphere as an enthusiast. Now to any good civil servant an enthusiast is a man to watch rather carefully. So beforehand, so that there shall be no misunderstanding, I disclaim for myself and I am sure for my Minister any responsibility for what he is going to say. But I am quite certain that anything that comes from him on this subject about which he is so enthusiastic will be well worth listening to and well worth considering at leisure afterwards.

*The following paper, illustrated with lantern slides, was then read:*

## THE PAPER

The honour of being invited to talk to you this afternoon comes to me partly as a representative of The Inland Waterways Association, and I think I should begin by defining the nature and aims of this organization, as experience has taught me that there are many misconceptions on the subject. The Inland Waterways Association has nothing to do with the Government. It is an organization comparable, perhaps, with the Council for the Preservation of Rural England, to which it is affiliated. It was founded in 1946 at a meeting of a few friends in my house; now it has about fifteen hundred members, and through ancillary bodies owns, or participates in the ownership of, several large properties. The principal aim of the Association is defined in its constitution as being "to advocate the use, maintenance, and development of the inland waterways of the British Isles, and in particular to advocate and promote the restoration to good order, and maintenance in good order, of every navigable

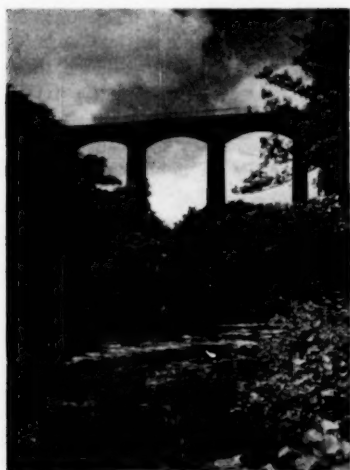
waterway; and the fullest use of every navigable waterway by both commercial and pleasure traffic". The Association is entirely non-political, and includes within its membership, Members of Parliament of all parties, among them being formerly our distinguished Chairman of this afternoon. We do not so much care who owns the waterways; we do care that the owners maintain them in good order and operate them efficiently. Our members are drawn from the widest possible range of people, for, as I shall endeavour to show, the subject of waterways touches life at many different points.

It is not only about the Association that strange misconceptions prevail. Concerning the whole subject of British inland waterways I have often paraphrased Mr. Churchill and said that there is no subject so large about which so many people know so little. This undoubtedly results largely from the peculiar history of the waterways.

Modern canal construction began when Francis, third Duke of Bridgewater laid out the Bridgewater Canal in 1761. Immediately before that the Sankey Brook had been canalized, and still exists as the St. Helens Canal; and, of course, there had been a number of earlier occasions when the navigability of rivers had been improved and extended by the introduction of navigation works such as locks. Indeed the Fossdyke Canal, which still connects the Rivers Trent and Witham, is supposed to have been laid out by the Romans. But the success of the Bridgewater Canal was so immense and immediate that its opening was followed by a canal boom in almost all parts of the country, during which about four thousand miles of canal and canalized river were laid out in fifty or sixty years.

Britain's industrial greatness was founded upon canal transport. But in due course the railways came. Since then for the canals there has never ceased to be trouble. The railways bought up stretches of canal, a bit here and a bit there, until at the time of the recent nationalization they owned about a third of the whole system, and through that third dominated almost all of it. Parliament, instead of restricting or prohibiting this process, positively fostered it: railway companies were compelled or encouraged to buy off canal opposition to their Parliamentary Bills by buying up the canal companies themselves, often at exorbitant prices, and with a consequent legacy of much bitterness. But in any case the railway companies had in most instances little incentive to work the canals efficiently; the idea was rather to secure all the traffic for the railways. Tolls were raised, restrictions imposed, and maintenance neglected.

I will mention two examples. They are typical of many. The Kennet and Avon Canal connects the Thames at Reading with the Bristol Avon. It has big locks, seventy-three feet by fourteen; it is a fine work of engineering by John Rennie, and passes through much lovely country. Clearly it should be reasonably busy. In fact it was acquired by the Great Western Railway in 1852. By 1906 the tolls for using it were described as being fifty per cent higher than on any comparable waterway in the country. Fantastic regulations were enforced: fires were prohibited in moored boats, thus literally freezing out the boatman, and what was known as week-end navigation was stopped, thus depriving the



[Photo by R. J. M. Sutherland, A.M.I.C.E.]

*The Pontcysyllte Aqueduct, Shropshire Union Canal, Welsh Section, designed by Thomas Telford. Two views of a stretch of the canal are shown crossing the river Dee. The photograph on the right was taken looking along the top of the aqueduct*

trader of one of the great advantages of canal transport, and making the development of pleasure traffic almost impossible. By about 1930 there was no traffic at all on this enormous waterway, which was simply falling into ruin.

The other case I will mention is the Welsh Section of the Shropshire Union Canal: the part of it which goes—or went—to Welshpool and Newtown. This waterway is quite simply one of the most beautiful in the world; a heritage which only a country of the blind would care to lose. It also carried trade. It also belonged to the London, Midland & Scottish Railway Company. In 1936 there was a small burst in the canal bank; a mishap which the regular maintenance gang could have disposed of in a day or two. But orders arrived from Crewe, and nothing was done. In consequence a pair of working boats was marooned on the far side of the burst, where they can still be seen; and their small owner ruined. In consequence also, a long-established boatyard was put out of business, and its proprietor forced to take work as an estate carpenter. None of these circumstances prevented Parliament from agreeing in 1943 to the abandonment of the canal on the fantastic, but customary, ground of "no demand". About three hundred miles of navigable waterway in all parts of the country were abandoned in that year, while, of course, the nation was otherwise preoccupied.

For at least a hundred years, therefore, inland waterways, though with some very important and distinguished exceptions, have tended to be Britain's forgotten industry. There have been a number of abandonments; but, in general, it has

been deemed injudicious to risk the opposition which large abandonment proposals would undoubtedly have aroused, and preferable to proceed by simply lying as low as possible about the whole subject, and doing everything to discourage traffic, in particular by neglecting the statutory obligation of good maintenance. For it must be emphasized that this obligation exists. Canals are normally constructed under Acts of Parliament which lay upon the undertakers the obligation to admit all craft of suitable dimensions and to keep the waterway in good order; and these obligations cease only when Parliament has agreed to the canal being abandoned. The Great Western Railway Company regularly stated in its Annual Report that the Company's canals had been maintained in good order, when latterly there was not a single one of them of which this could truly be said.

Public opinion has never been entirely easy on the subject, however; and perhaps the most remarkable thing of all has been the series of public enquiries of various kinds, the last of them as recent as 1942 (the late Frank Pick presided over it), which have unvaryingly recommended that the canals be in some way removed from the hands of the railways, and redeveloped in the national interest. What is remarkable about these recommendations is that no single one of them has ever been acted upon—anyway not specifically; a little has been done as a by-product of nationalization. The best authority for the disastrous influence of the railway companies and of public and official apathy upon the canals is the twelve volume Report of the great Royal Commission which sat for several years from 1906. After all, the subject is important. Do you know that Paris is the leading port of France, and that, to plunge for a moment into politics, there are enormous increases in waterborne trade, both in the United States and in Russia?

What is mainly wrong here is in my opinion the niggardly and parochial spirit in which the subject is commonly approached. This, of course, is far more discouraging than the actual administrative inadequacies, though these are bad enough. Until nationalization in 1947 there was no Canal Clearing House, so that the merchant, shipping by canal from London to Liverpool, had to pay five separate, and widely disparate, tolls. The canals were, in fact, operated precisely on the turnpike road system, which on the roads had been discarded a hundred and fifty years before as an intolerable obstruction to trade and prosperity. The condition of consecutive sections of waterway would differ enormously, largely according to whether or not the section was in railway ownership. That any canal trade continued at all under these conditions was the wonder; the wonder and the proof that canal transport must have considerable inherent strength. These particular abuses have now to some extent been remedied, but the position still does not begin to be satisfactory.

The *Transport Act* of 1947 transferred a large proportion of the waterways system to the British Transport Commission, who operate it through the Docks & Inland Waterways Executive. The schedule of navigation undertakings to be nationalized under the Bill was originally remarkable for some striking omissions: the Manchester Ship Canal was omitted, which is the largest artificial navigation

system in England; so was the River Nene, which has recently been modernized throughout its very considerable length; so were the railway owned navigations, which, at the time in question, amounted, as I say, to about one third of the whole system. Therefore a deputation from The Inland Waterways Association visited the Ministry of Transport, where we were interviewed by a very important Civil Servant (we could tell this by the facts that he had a room to himself, a carpet, and three drawers to his desk), at whom, after the usual preliminary courtesies, we aimed our questions. These were the answers given us. The Manchester Ship Canal was to be the subject of a "separate bargain". This bargain seems never to have materialized; but we have no complaints because the Manchester Ship Canal, and the Bridgewater Canal which is now owned by the same company, are operated with great efficiency. The River Nene, and many other navigable waterways in the eastern half of the country, have not been nationalized because during the recent war they were not controlled by the Ministry of War Transport, being regarded as unduly exposed to attack. This seemed to us a somewhat pessimistic and irrelevant criterion. But when we asked about that one third of the system which was railway owned, the answer given us was (and I was among those present): "Oh! Do we get them too?"

Unfortunately this level of disinterest continues in too many responsible quarters. If you, as a member of the public, write to the British Transport Commission enquiring their waterways policy, you will be told, often with some vehemence, that most of the waterways are hopelessly obsolete and a burden upon the Commission. Dangerous weight is given to the lazy argument that because many of the waterways have been neglected, however bad the reasons, and traffic positively discouraged instead of sought for, therefore the task of restoring those waterways is now an impossible one, and the quest for traffic hopeless. Anyone who has tried to send by water any cargo in the least out of the ordinary will agree with me that it continues to be the wonder that any canal trade remains. Enormous trouble was recently gone to in order to prove to a firm in Leicester, which wanted to consider canal transport, that the whole idea was out of the question, although the canal to Leicester is sinking into weedy disuse. Even more trouble was taken to convince us, to whom the Leicester firm referred the matter. Not even a rate could be obtained. The strongest argument used was that all the goods would have to be taken by road from Brentford. This although the canal passes right through London. The procedure can without exaggeration be described as that of normal business in reverse; and it is the procedure which rules in most parts of the country, except in the case of a very few bulk cargoes which call for little initiative.

In 1950 the boatman got a pennyworth of publicity for every £7 he brought in; the road haulier for every £3; and the railwayman for every £1 14s. 0d. The Docks & Inland Waterways Executive hardly takes the idea of going out for traffic as being within its terms of reference; and such traffic increases as there have been are largely confined to the estuarial navigations. The Executive is riddled with timidity, defeatism, and impecuniosity.

Undoubtedly the business is burdened with years of neglect, and a substantial



[Photo by R. J. M. Sutherland, A.M.I.C.E.]

*Dereliction: the end of the unabandoned Peak Forest Canal, at Buxworth: the main portion of the canal is in better condition—at the moment*

capital investment is needed. On waterways the proportionate gain from extra traffic is greater than on any other form of transport, and extra traffic does not wear out the waterway at anything like the rate at which it wears out the railway or (still more) the road. The more the waterways are employed, the greater the proportionate gain when compared with the extra employment of railways. This point is of the first importance in the national economy. Much could be done by making proper use even of the present resources. A year or two ago the number of men employed in maintaining the Kennet and Avon Canal was almost exactly equal to the number employed in maintaining the Caledonian Canal; but on the Kennet and Avon little attempt was made to see that it was the navigation which was maintained and not the hedgerows. This situation exists on many waterways, and is important.

What is wanted is a determination to maintain all our navigable rivers and canals at least as well as we maintain our roads, and equally as a matter of course; a resolve to let slip no opportunity to derive advantage from them. The commercial advantages of canals have been set forth many times, and are described in the publications of my Association. I am now going to refer to certain other aspects of the subject, some of which are entirely new, and therefore as yet receiving insufficient attention.

As a matter of fact, the subject suffers considerably from its very variety of



aspects. People find it hard to believe in the validity of so many functions. Allowance is seldom—I might say, never—made for the cumulative importance of all these different factors.

I am first going to allude to the factor which may seem most remote from the commercial factor which so far we have been mainly considering. That is the factor of beauty. I should like to suggest to you that, where the works of man are concerned, our country is supreme in three things: our Parish Churches, our eighteenth century houses and our inland waterways. The distinction of our inland waterways is two-fold: most of them were laid out during that wonderful but brief period of the very early industrial revolution when beauty and utility equated; and most of them, unlike other achievements of that period, have survived. It is astonishing how few people are aware of this heritage, but no less astonishing how even the most unlikely people become enthusiastic about it as soon as they really encounter it. The great engineers who laid out the waterways, James Brindley, that universal genius Thomas Telford, John Rennie of old Waterloo Bridge, themselves designed the navigation works, the lock cottages, the warehouses and, most beautiful of all, the aqueducts and innumerable bridges. In consequence you travel by water through mile upon mile of harmonious environment. The satisfaction this gives is precisely the satisfaction which the modern world so completely lacks. Across Telford's Macclesfield Canal are 118 bridges, most of them mere occupation bridges for farmers. All of them were designed by Telford, all use the local stone, and all are in the same idiom; but I think it is true to say that no two of them are exactly alike. Even the passage of an industrial town by water is commonly full of interest; partly because the canal came first, and therefore the best industrial buildings stand along it. (The modern highway came last and has the Nissen huts and Portal houses.) The inland waterway combines the best of nature with the best of man. Have we really fallen so low that this beauty means nothing to us, or is to be regarded as now beyond our means? If so, it is hard to see why we bother to go on living at all.

This brings me to a second new factor of the greatest importance. It is the holiday factor. Millions of people are now by statute receiving holidays with pay for the first time. The congestion likely to be caused by this has so far been largely averted by the fact that enormous numbers of those receiving holidays with pay are not leaving home. A director of an aircraft company, certainly a high-wage industry, recently told me that fewer than half of his employees who received a holiday with pay actually went away. This state of affairs is doubtless attributable to rising costs and to the time it takes for a new habit to become established. It is probable that in the end the great majority of those given holidays by our legislature will take them. It is hard to believe that the holiday camp is the answer to this problem for all concerned. Especially if we are to continue as a democracy. There is no doubt that for many, the waterways provide an ideal answer. This is no theory. You should see the Association's morning mail, right back to our very first days. At least half the letters ask for—as they almost always term it—a “holiday on a barge”. All this with almost no



publicity for canal holidays. The family man cannot suddenly take his family for a fortnight at sea. A holiday by inland waterway calls for exactly the right, the beneficial, degree of resource and initiative. There is never a dull moment from the time when the voyage is planned until the last day out. During the whole of the following winter, you will not get a cold; and the holiday will give you that greatest of all joys, the peace of mind which comes from purposeful but pleasant occupation.

Pleasure traffic could be a most important source of revenue all over the waterways system. Consider how much it contributes on the River Thames. The development of the Norfolk Broads has taken place mainly in very recent years, and to a significant extent owing to the initiative and efficiency of a single firm. Elsewhere the former owners tended to restrict or even prohibit pleasure boating, but here the Docks & Inland Waterways Executive really has turned over a most welcome new leaf. The trouble now is mainly that the former policy has led to an extreme shortage of suitable boats, and that this is a bad period of history for the development of an entirely new pleasure industry. But the demand really does seem to be almost unlimited, and sooner or later the right person will inevitably come forward to . . . canalize it.

I must refer also, though briefly, to another factor: that of water supply. There is concern in many parts of the country that the water table is falling,



[By courtesy of the London News Agency Ltd.]

*Working boats at Market Harborough, Grand Union Canal*

and that the demand for water is steadily exceeding the supply. The suggestion that water be sold by meter has at last become serious and active. More to our point, vast sums are being expended upon the construction of new reservoirs which often put out of commission large areas of agricultural land. A scheme is in hand to water the town of Coventry by pumping water from the River Severn to the top of Bredon Hill (of all places). There is no doubt that much more use could be made of the existing inland waterways system; and even less doubt that new and wider canals could both carry large trading vessels into the heart of the country, and bring water to the towns from the rainy districts of Wales and the Pennines. A particularly ingenious scheme of this nature has been devised by Mr. J. F. Pownall, who names it the Grand Contour Canal. Mr. Pownall demonstrates that a canal running along the 300 foot contour line, and therefore needing no locks, would serve the most surprising number of populous districts in all parts of the country. It would, of course, feed water to, and be fed by traffic from, the existing waterways system and new branch waterways. Mr. Pownall's scheme has a reasoned adventurousness worthy of Brindley himself.

This possibility of using canals for water supply brings me back to the urgent need for a wider view, for the widest possible view. There is a scheme under consideration for using another part of a canal I have already mentioned, the Welsh Section, as a means of feeding water from the River Dee into a reservoir near Nantwich. As the distance involved is about forty miles, and as the canal in question is otherwise in danger of final closure, the scheme has much to commend it. But I mention it now because it seems to be taken for granted that if the scheme goes forward, it will be impossible to permit the waterway to be polluted by the passage of boats. With modern purifying plant, this surely seems excessively cautious; but the notion is typical of the strict departmentalization which afflicts the waterways. For example, two Ministries additional to that represented by our Chairman are concerned with the subject; not only the Ministry of Transport, but the Ministry of Agriculture and the Ministry of Health also. There are major navigable waterways, bearing considerable traffic, with which the Ministry of Transport has almost no concern. The Great Ouse is an example. And the Ministry of Agriculture, which is concerned, will tell you most frankly that it has no interest in boats or traffic, but is entirely preoccupied with the question of drainage. This view of the matter the Ministry has duly implemented on many waterways in Eastern England, such as the River Welland and the Brandon River by replacing the former locks by fixed stanches, and thus making a once navigable river into lengths of dead water. And all at your expense.

At this very moment it is proposed to spend millions of pounds on the Great Ouse catchment area, but the possibility of restoring the derelict locks on the upper reaches of the river, and thus making Bedford accessible by water as it used to be, is almost outside the Ministry's scheme of reference. The Docks & Inland Waterways Executive is similarly cramped. I have mentioned that it is deficient in salesmen and publicity resources. It is interesting to note that

on the Bridgewater Canal, which is still privately owned, receipts multiplied by more than three in the four years which ended in 1951, the increase being attributed by the Chairman of the owning company not to a local trade boom, or to the rearmament drive, but simply to the acquisition of the latest types of barges, tugs, and other plant. The Executive is not provided with the capital required for such necessary renovations. It is only needed to compare the Executive with the Thames Conservancy to see that the Executive is entirely inadequate to foster pleasure traffic, with all its possible increment of both revenue and national well-being. Still less is the Executive able to take account of the æsthetic aspects of its subject, although it is in respect for such things of the spirit that the difference lies between the pasture and the desert.

I suggest to you that the first need is for a firm decision that no more navigable waterways shall be abandoned or allowed to become derelict. After that everything possible should be done to stimulate all the uses of rivers and canals, and to preserve their beauties. Modern methods should be brought to bear in every department, in place of defeatism, and spoon dredgers which date back to the earliest times and are still the very latest thing on too many waterways. In the end we should set about the work of recovering the waterways we have lost. It is clear that no existing authority is competent to deal with the vast and varied subject as a whole. For this reason, as some of you may have noticed, Sir Alan Herbert, who is President of The Inland Waterways Association, and I recently suggested in a letter to *The Times* that the need is for a National Waterways Board, which would supervise the entire waterways system, without necessarily owning all of it, and upon which would be represented all the interests involved. The need is very urgent. Sir Reginald Hill, the Chairman of the Executive, stated a few weeks ago that further extensive abandonments were in prospect of waterways which cost the Executive £400,000 per year to maintain. Even if we take the view that the income from these waterways cannot be increased (which is absurd), is the sum mentioned not a very small one by modern standards when we consider the many advantages which can be derived from the national assets upon which it is expended? Should we not at least go on spending it in order to keep these waterways in existence while we evolve means of making them pay their way, as can almost certainly be done? If many more waterways are abandoned, the system, which at present extends from London to Kendal, and from Bristol to Ripon, will cease to exist as a system. I hope you will agree with me that that would be a national disaster. The National Waterways Board would certainly require to be subsidized at the outset, and some particular waterways might not pay in isolation, but I am convinced that if fully exploited and efficiently managed, the system can be made to pay as a whole. If that can be achieved, I hope I have succeeded in convincing you that even the lesser waterways have an important place in the national life and are worthy of preservation, especially in an age when trade and industry are more on the move than ever before. To-day's backwater may be to-morrow's main artery.

In the meantime the work of recovery is being carried on by amateurs at their own expense. I am going to mention the work done by Members of The Inland

Waterways Association at Linton Lock in Yorkshire; and on the Rivers Avon and Great Ouse by the Association's offspring, the Lower Avon Navigation Trust and the Great Ouse Restoration Society.

The Linton Lock Commissioners control not only the lock, but also nine miles of the Yorkshire Ouse. These nine miles were not nationalized, although the waterway both above and below this particular stretch was. In this and other cases I think the principle applied was one of excluding so far as possible the more troublesome undertakings, for in 1948 Linton Lock ceased to operate, because under-water leaks which had been apparent for some time had suddenly become severe. The Commissioners obtained estimates for restoring the lock; but they were all in the region of £1,500—£2,000, which the Commissioners could not afford, although the lock at the time was bringing in an annual revenue of about £400, mainly from sand and gravel traffic. Traders interested contemplated legal proceedings, but the Commissioners made it clear that if ordered by the Court to restore the lock, they would simply go bankrupt. At this point two Members of the Association's North-Eastern Branch were added to the Commission. They obtained an estimate from the Association's honorary consulting engineer, Mr. Cyril Boucher, in the much lower sum of £1,000, which the Branch undertook to raise by public appeal. The appeal was successful, and the actual restoration cost £984. The lock is now working once more, bringing in revenue, and enabling your boats to pass from one of your waterways to another of your waterways.

The Great Ouse fell into disrepair following an endless and ruinous series of law suits between the former owners and certain other riparian interests. Later the river came under the control of the Great Ouse Catchment Board (now River Board), who, unlike many Catchment Boards, were actually required by Parliament to restore the navigation works. This they did, until the last war; after which the funds available were insufficient to complete the work. The river is now navigable to Tempsford, but nine more locks require to be restored, and dredging done, to make it once more navigable to Bedford. The Great Ouse Restoration Society, which was set up at a meeting in Bedford Town Hall addressed by Mr. Peter Scott and myself, has as its aim to persuade public and official opinion to finish the job. I am glad to say that it seems to be making excellent progress.

The scenes of ruin on the Great Ouse are unfortunately typical of many once well-kept waterways. I think you will agree that they are a national disgrace. I may add that the situation both on the Great Ouse and at Linton Lock is made much more difficult by various legal restrictions. The Linton Lock Commissioners, for example, are not permitted to charge tolls upon pleasure craft. And the legal position on the Great Ouse is so hopelessly complicated that only a clean sweep and a new start will enable the navigation to be operated with real efficiency. I emphasize, therefore, the need for standard legislation covering all navigable waterways.

Lastly, I must refer to the recent sensational happenings on Shakespeare's Avon. The Avon was formerly navigable to Stratford (and sometimes above

Stratford), where it made connection with the Stratford Canal, which leads up to the industrial Midlands. In the middle of the last century, the Great Western Railway Company purchased both the Stratford Canal and the Upper Avon, the part of the river between Stratford and Evesham. They put the Upper Avon out of commission in twenty years: probably a record. They were able to do so because the Act controlling the navigation unfortunately made the obligation upon the proprietors to maintain the navigation works contingent upon their continuing to collect tolls. The Great Western Railway therefore simply ceased to collect tolls; and when some traders proceeded against them for neglecting the waterway, it further transpired that the actual purchase had been made by a nominee who had now disappeared, so that the proceedings could not proceed for lack of a defendant. In the meantime the Lower Avon, from Evesham to Tewkesbury, where it joins the Severn, had passed through a series of hands until it too had fallen into a very poor condition. Rather more than two years ago the waterway was acquired by a new non-profit distributing company, the Lower Avon Navigation Trust, which set itself to raise £20,000 by public subscription. It has already raised about half that sum: surely a triumph under modern conditions. The Trust is largely the creation of its brilliant Chairman, our member, Mr. C. D. Barwell, a Birmingham business man, who had brought to its service administrative capacity of the very highest order, and to whom the



[By courtesy of the Birmingham Gazette]

*The Pishah carrying 45 tons of bulk wheat down the Avon to Pershore. The boat does this trip from Sharpness twice a week regularly*

whole country owes a deep debt of gratitude—for gratitude is all he is likely to get out of it, beyond his own satisfaction. Great interest has been aroused, extending to sociologists in the United States, by the wonderful contributions made to the revival of the river by unpaid volunteer workers. Last summer the town of Evesham raised more than £4,000 by its Annual Carnival, which that year was in aid of the Avon Trust. The money was spent in restoring Chadbury Lock; with which work the Trust were successful in incorporating a Royal Engineers training scheme. This fine work really made me feel that the Association's cause was getting somewhere.

I hope you will all see that it goes the whole way.

## DISCUSSION

SIR WALTER GURNER, C.S.I.: I want to ask a question or two about the reclamation of the Lower Avon. It is a project of special interest because, if I remember rightly, the Warwickshire Avon was the first river to be formally canalized for navigation purposes under Royal Patent in 1635 in Charles I's time, and The Inland Waterways Association are now reviving it three hundred years afterwards. The point I want to raise is this: the capital involved will be about £20,000, and we have seen most interesting slides of the progress made and, at the same time, the speaker said something which made me feel a little despondent, he said the return would be gratitude alone. As things are nowadays gratitude will not take you far, and I was wondering whether some return can be expected from the revival of holiday traffic, particularly between Tewkesbury and Evesham. Of course, there was one other very material advantage, that the river at Evesham was itself threatened by the insecurity of the lock up till about four or five years ago, and the work of the Association has entirely solved that problem.

THE LECTURER: The inquiry is very briefly and simply answered. What I said was, although perhaps I did not make this quite clear, that Mr. Barwell personally would get nothing out of it except gratitude. I think it is necessary to make that quite clear. He is not in the enterprise for an investment. But there is no question but that the Trust Council's policy is to make the waterway a paying enterprise. It should at least pay its way as a waterway and, of course, the intention is that any profits which may ultimately accrue will be returned to the maintenance, because it is a non-profit distributing company. I would say myself, and I think I have Mr. Barwell with me in this, that there is an expectation of greatly increased traffic. I think the river should play the part in the life of the Midlands that the Thames plays in the life of London; but there is also a prospect of increased trade. There is a well-known vessel, the *Pisgah*, which goes up and down the river carrying sixty tons twice a week, and that is quite a bit. But there is every hope, when the river is restored, of a great increase in commercial traffic.

MR. F. NEWHOUSE, B.SC., F.C.G.I., M.I.C.E.: I think most of us have been aware that the way the canals have been treated for many years past has been scandalous, and we owe a great debt of gratitude to the lecturer for showing the absolutely unforgivable way they have been treated by the railways under private enterprise, and as badly, if not more so, by the railways when nationalized.

There is one point which is important in the consideration of this matter. We have had no figures at all about what it would cost per ton mile for the transport by canal of suitable goods, such as stone, ballast, coal and so on. Has anybody ever made an estimate of what it would cost to put one of these canals into decent working

order and to maintain it, and, on a conservative basis, what the traffic and the return would be. I think that is one of the most important things to decide if you are going to get any support from influential corporations in this matter. We cannot at present, I think, afford to spend a lot of money just on improving the opportunities of pleasure of the British public. That, I think, is the most important point that we have to consider in the life of the canals.

There was another matter the lecturer mentioned that I did not quite understand. He referred to a contour canal which was going to flow some large number of miles along a contour. Water can only flow if it is falling, even if it is only falling three inches a mile, which is very little. How can it stick to a contour? That is a question that, as a water engineer, I should like to have answered if possible.

THE LECTURER: To answer that fully would require another paper. There are at least three questions, so may I start with the last, as it is the simplest, the contour canal? Of course, the best thing to do would be to get Mr. Pownell's book on it, which answers all questions. Although the main line of the canal runs along a single contour it has many branches which go down or up locks, down mainly, to adjoining towns; and, of course, the passage of traffic through the locks would ensure a flow of water and so equally would the other function of the canal, which is water supply. Millions of gallons would be drawn off all the time as water supply. I do not think there is any difficulty there.

The other two points are more formidable to answer. Has any real estimate been made, I think the speaker said, of the cost of restoring a waterway? And second was the question of competing transport costs. There have been quite a number of estimates formed of the cost of restoring waterways, several under our auspices. They are, perhaps, comparatively humble, but they are not all that humble. For example, I mentioned the Avon, which is to cost £20,000 up to Evesham; and we also have estimates for the cost of restoring the Derby canal and the Stroudwater canal. Both have been obtained officially and are the work of qualified civil engineers. The outstanding feature of all of them (I am not going to name figures because really that is too complicated—I could tell you the overall figure but I do not think it really arises) was what I mentioned in the case of Linton Lock. I perhaps did not make the point there altogether clear. You remember that the Commissioners got estimates of £2,000 and said the money could not be found, and we actually did it for £984. That situation is paralleled in many other cases. If I leave any thought with you I want to leave this one: everything turns on the spirit in which the thing is approached. We had one case where these were the facts: we were told that a certain canal would cost £400,000 to restore; it is a comparatively small canal in a very bad way. On commonsense grounds, we did not believe that, and we got our consulting engineer to do an estimate, with the consent of the canal company. He got it down to less than £100,000, on which basis, if we had had the money, we would gladly have gone ahead from a commercial point of view. There is an enormous amount of inflation of these costs, and I would like to emphasize the need of getting the most out of what is already there, and that quite a lot could be done in this way with the right spirit instead of one of hopelessness and defeatism.

The question of competing costs of transport is one with which I am not going to entangle myself on this occasion. It is really appallingly difficult. To the best of my belief there is no really authoritative account of the real cost of transport. This Association has persisted from the first in simply saying that what we want is another public inquiry into this matter. I know there have been several, but we do think another one is wanted with terms of reference which would include ascertaining the real cost of competing means of transport, because the rate structure has become complicated with more than a hundred years of historical circumstances, so



that it is very difficult indeed to answer that. One can only say that a lot of public inquiries which have reported at length and in detail have advised that in many cases canal transport is the cheapest, and we consider that this needs putting to the test again in the circumstances of to-day.

MR. C. ARNOLD-BAKER (Secretary, National Association of Parish Councils): I come from the National Association of Parish Councils. There are about five thousand parishes which belong to my Association and navigations pass through many hundreds of them. One of the issues with which this Association is very much concerned is the slow decline in the amenities of country life. Therefore, when it is said that the country cannot really afford such things as pleasure boating one cannot help wondering whether this might not be one way in which country dwellers can perhaps be interested in their own districts, if they have a canal nearby, and the steady migration from the country to the town be combated. I should like to offer that as a social consideration for spending a little money on these canals.

There is also another thing: if people boat for fun and pay for fun why cannot rates be so adjusted that they will subsidize the commercial traffic?

MR. E. W. H. CHRISTIE: I am a member of The Inland Waterways Association and I also own commercial and pleasure boats. I would like to say a word about what the last speaker said. There are three thousand pleasure craft on the inland waterways in the Midlands alone, and these are paying a fee, in most cases of £10 a year, for their licence, quite apart from the fees they pay for lockage. That is an income of something like £30,000 a year that The Docks & Inland Waterways Executive is getting which the canal companies never got before the war. It simply did not exist as it is entirely the result of the activities of The Inland Waterways Association. That is the first point. We, I mean the boat-owners, are bringing a large new income in, sufficient to put one canal a year in order if it were devoted solely to that, and I think that pleasure boat owners are entitled to be heard.

I also own tugs and barges in part and I am having very great difficulty at this moment in getting work for them and making them pay. I am not having any difficulty in getting work offered to me; where I am having difficulty, is in being able to use the canal at all. The Minister of Transport recently stated in the House of Commons, I am sure in good faith, that the main lines of the canal system had now been dredged by the Executive, which is satisfied they have now been dredged to a depth which would enable working boats to load to their full capacity. That is absolutely untrue. I do not know who told him that, but I should be very pleased to take the Minister of Transport in my boat, which draws four feet six inches, from London to Birmingham and I will give him a pound for every mile we can go if he will give me a pound for every mile we cannot.

My partner recently had an offer to tow another company's barges on the Executive's canal system. He rang up a responsible official at the South-Eastern Division's headquarters and he said, "I've had this offer. Will you kindly tell me how much you will charge me? What do you propose to charge me for permission to use my tug to tow other people's barges?" The reply was this, "Well, you know, we operate our own tugs"—this was the Executive—and my partner said, "Yes, I know you do, but I want to know how much you will charge me to operate mine". "Well", replied the official, "I'm afraid I can't quote you a rate, but I can tell you this, it will be quite prohibitive". That was in spite of the fact that the Executive have just lost an action in which they attempted to prevent a private enterprise company using Immingham docks in this way.

I will give you another example of the difficulties that the boat owners find to-day in providing the sort of service it wants to industry. We have been negotiating for



some time with oil firms on the possibility of carrying very large quantities of oil up the river Thames and also from Avonmouth. From Avonmouth you go to Reading by the Kennet and Avon Canal which is at the moment, of course, completely impassable, and the Docks & Inland Waterways Executive are not prepared to let us use it. Now supposing we want to go the other way, by the Thames. The Thames Conservancy put a fivepence a ton mile surcharge over the ordinary rates on petrol carried on the Thames. I have not been able to get an explanation for this beyond the remark of one of the officials that if the barge carrying the oil were to sink it would be very bad for the fish. It probably would, but I do feel that is a risk which the fish must take. That fivepence a ton is just sufficient to make it uneconomic to carry petrol by boat, but if it were not there the oil companies would be delighted to use the Thames and the Kennet and Avon Canal, and I do not doubt they would be prepared to do something towards putting the canal in order, either by forcing the Docks & Inland Waterways Executive to put it into order or by putting the money up themselves. On the whole we who are trying to carry by water feel we can cut the railway rate, even with all the charges I mentioned to you, by between five and seven shillings in the pound. That is to say we can deliver goods between five and seven shillings in the pound more cheaply than the railways can: I do not say every type of goods, but most types of goods, and that is even when we do not load our boats fully—we cannot use fully-laden boats because there is not enough water—and pay all sorts of extraordinary additional tolls like ninepence a ton for carrying over the Executive's towpath. I am quite certain that if the canal and river carriers were given a free hand they and road transport between them could put the railways out of business in eighteen months and, if I may so, that is exactly the reason why we are not going to be given that free hand.

BRIGADIER-GENERAL SIR OSBORNE MANCE, K.B.E., C.B., C.M.G., D.S.O. (British Delegate, Central Rhine Commission): My own mind turns not to the gallant keeping in repair of certain canals which, by the pleasure they give, has evidently been justified, but to the statement by the lecturer that he would like all the abandoned canals brought back into traffic again as he was certain that the canals of this country would pay their way. That is coupled with the question of the cost of canal operating. I may say on the latter point that when I went as Director of Canals to the Ministry of War Transport during the war, the first file I started was a file on the cost of operating canals. I am ashamed to say that when I left three years later it was still my smallest file. It is very difficult to get information on costs, but it is very important to get it. The kind of information I was trying to get was the relative cost of operating the small boats on the narrow canals and the Trent boats. The canal question must be dealt with on broad lines of national policy, and that is based on the fact that I do not think it will be permanently possible to work the narrow small boat canals commercially. Even during the war it was only because a pair of boats was worked by a family who lived on the boats that it was possible to earn enough to provide an adequate wage for the family. If, for example, the authorities insist on stricter educational requirements for the children and it becomes necessary to employ two men on a pair of boats, the revenue from the tonnage it is possible to carry will not be sufficient to pay a reasonable wage. I think therefore that if we leave our narrow canals as they are at present, most of them will gradually fade out, unless the Government is prepared to subsidize them liberally. I ventured some time ago to read a paper outlining a future policy for our canals. It was based on a piece of technical research which was carried out during the war as to the size of boat which would enable the crew to earn adequate wages while competing with the railway tariffs. A standard motor boat of the size recommended would carry a hundred tons. The barge would carry about a hundred and twenty tons. Assuming that this is verified—and we had the best canal brains on the job—we must then think in terms

of improving some of our canals to take that size boat. In principle it would be the "cross", but not the old "cross" of the Royal Commission because, in these days of motor lorries for delivery, you do not need to go four hundred and fifty feet up to the top of the Birmingham Plateau; your main cross routes would go round that plateau. I think it would need something between twenty and twenty-five million pounds to improve the system of canals to take the standard boat. It would be, of course, reckless folly to spend that money now on canals. But if we ever have unemployment, canal construction of that kind would be one of the best employment balancers that you could think of, and we would be economically justified then in spending money on jobs which might not, for some years, earn their full interest. Unfortunately a corollary of this is that we ought, if we had looked ahead, to have started a traffic investigation immediately after the war so that as many as possible of the industries which had then to be displaced or reconstructed might have been placed on sites which would later on become canal heads. Road and rail access might have been given to begin with, but also a future service by canal, which would take goods direct between the ships in the estuaries and works—not only that but, if required, under bond in sealed barges as they do on the Continent. That is the kind of line upon which I feel there might be a chance of having a really healthy canal industry in this country, but whether there is any likelihood of it, I will leave you to guess.

MAJOR W. H. CADMAN, M.B.E., B.SC., F.R.I.C.: There is just one aspect of the subject which I think the lecturer might have enlarged upon, that is the question of fish. These inland waterways have always been and always will be a source of great pleasure for anglers and I would like to ask whether The Inland Waterways Association considers them at all in connection with their activities. I mention this, because in East Anglia where I am now situated, every angler has to have a three shilling annual licence to fish, and a few River Board inspectors, at week-ends particularly, are on the alert to ensure that the angler has this licence. Most of the money obtained—a considerable amount—goes to the upkeep of the inland waterways, the rivers and the Norfolk Broads, dredging and clearing weeds, etc., and that is appreciated tremendously by anglers. Is that aspect of the subject taken into consideration?

SIR REGINALD HILL, K.B.E., C.B.: I will not say I agreed with everything which the lecturer said, but I do believe that fundamentally we are in sympathy though we may differ occasionally as to the ways in which we should get to the commonly desired end.

I noticed that one of the speakers threw out a challenge. I do not know whether the Minister proposes to take up that challenge, but I feel inclined to accept it on behalf of the Executive. I naturally should have to stipulate that there should be agreement as to the route to be followed and craft to be used because the statement which has been given referred to certain routes being used by certain types of craft. Perhaps the Ministry will appoint a referee in case of there being any difference of opinion!

I should also like to have the particulars of certain complaints which were made of which I had not previously heard, and no doubt those particulars can be provided.

To come back to the paper, I think one may fairly say that there are two broad subjects embodied in Mr. Aickman's paper. There is the commercial aspect of the waterways and there is the aspect of private amenity, and those two do not necessarily go together. A perfect commercial canal is one that runs as straight as possible, has steel piled or concrete piled banks, has a line of wharves and factories along its banks and so on. But that is not the ideal canal for touring. I think personally there is room for both. As far as the commercial canal is concerned we have, in

the Executive, been doing our best within the few years we have been in existence to rehabilitate those canals which promised any return on capital or other expenditure. In five years we spent something like seven million pounds on maintaining and restoring these main lines of canals, and the speaker who asked a question as to what it would cost to put back canals might be interested to know this.

I should like to deal for a moment with the amenity side, and here I think there is very general agreement. Mr. Aickman mentioned in his paper a figure which I gave some time ago, but I think he slightly misunderstood my meaning about the figure of four hundred thousand pounds. What I said was that we had spent last year four hundred thousand pounds on canals which did not carry any traffic, or at any rate very little traffic, and that that figure would have to be reduced. I think it was perhaps taking it a step further to say that all those canals are immediately threatened with abandonment. After all, "abandonment" is rather a technical term in relation to canals. It does not necessarily follow because a canal ceases to be an obligation on an owner to maintain it to the standard necessary to carry a laden barge that it goes out of existence. The amenity aspect of the problem, with which the lecturer is very much concerned and with which I thoroughly sympathize, can be dealt with in a different way. Personally I would like to see a new approach to this subject. The canal is only one of the many amenities which abound in this country which we all should be very glad to see receiving a larger measure of public interest. Whether the maintenance of canals maintained as amenities should fall entirely as a burden on the shoulders of the user of public transport is another matter. I need only mention the highways as an instance to the contrary.

I should just like to add this suggestion that, particularly in regard to the question of preserving the beauties of the canals which are no longer used commercially, it might be better, instead of brooding over the past or recriminating over the present and the future, if we could get together and see whether appropriate means could not be found of preserving these canals and also the structures upon them for the enjoyment of the people and the glory of our country.

THE LECTURER: With regard to the earlier speaker's question about fish, I must apologize for omitting a reference to angling. That is indeed another ancillary activity. I am not an angler and I know nothing about this question at first hand, but I know a lot at second hand and a great deal that is very contradictory. Some anglers seem to take the view that every boat that comes along the canal is an absolute pest; scowls appear on their faces and, in some areas, stones fly through the air. But on the Chesterfield canal and others we are constantly getting communications in favour of restoring the waterway, even offering cash if necessary. About two years ago we made up our minds where we stood on this question; we took the advice of the London Angling Association, and they said that boats are beneficial from the point of view of fish and anglers and therefore we say that anybody who throws a stone should have this ruling quoted to them. We are certainly in favour of it and, as the speaker said, there is a quite considerable supplementary revenue from this source.

I am, of course, familiar with Sir Osborne Mance's conclusions and I think from the point of view of commercial traffic they are very valuable conclusions, but he did seem to me to concentrate entirely on that one aspect. I think I can best answer very briefly by asking you to remember that I did suggest in my paper that all the different aspects should be considered equally. I am the first to admit that if you take these different things separately—if you take the Great Ouse as a drainage channel and the Grand Union Canal as the great artery of commerce—then both are not doing very well. Although all the functions do not apply in equal proportions all the time I do think the answer is a single authority which is competent to consider every aspect of every waterway and to foster all these different aspects. If that is done I should be very surprised if it proved necessary to abandon much.

On the other hand, Sir Osborne did quote me as saying that I thought every abandoned canal should be revived. I did not say quite that. I said that the existing canals should be revived, and after that we should proceed—but I meant one at a time in the fairly distant future—to consider those that had been abandoned.

This question of spending money is really controversial. The Great Ouse Restoration Society received a communication from the Ministry of Agriculture saying that in the present state of the nation restoring locks on the Great Ouse was not justified; and the Society had to consider what to do next. I can never remember a time—but I am still on this side of a hundred—when the nation was not in that state. If we are not at war then we are preparing for war, and if we are doing neither then there is a slump, and whatever you do the money is never there. I think it is a most extraordinary thing that the money is there for other projects. You can always find the money if you want to, that is my view and I am sticking to it. I do not think the state of the nation has anything to do with this particular argument.

Sir Reginald Hill was very fair and, if I may say so, he made an admirable contribution. As he says, I do not think we disagree on very much except, perhaps, on emphasis and the matter of degree. I agree very strongly with Sir Reginald, indeed I said myself, that the burden of maintaining the waterways should certainly not fall entirely on the users of public transport. That is exactly what I was saying. If that is done the waterways will pack up. I do not think there is any disagreement. The burden should be spread as widely as possible, and there I come again to what I said: another public inquiry is needed with very broad terms of reference. The previous ones have had too narrow terms of reference; they have simply been concerned with the functions of the canals as commercial carriers, and even then they have uniformly reported that much should be done to restore them.

Sir Reginald raised another point which I should like to mention, particularly as this is the Royal Society of Arts. He said that the canal which was the most commercially efficient was the most deficient in amenities. I think that the Royal Society of Arts should think very carefully before endorsing that view, which seems to me a most disastrous one. I did cite, as one of the arguments for canals in general, that they were largely constructed at a period when that view was not only not taken but not known, when there was, for some mysterious reason, an equation between beauty and utility. *The Times* once said in a leading article that architecture in England perished with the Shot Tower, built about 1827, I think. That has a great deal of truth, but I do not think we should resign ourselves indefinitely to the appalling idea that if a thing is commercially useful it must be hideous.

I have one final point not exactly arising out of what Sir Reginald said, but something he said put me in mind of it. We are, as I said, a strictly non-political organization. We have had some remarkable members, most inclusive in all directions; but when Sir Reginald and some other people suggest that, as recently stated in *The Times*, the waterways should cease to have any kind of single authority and be transferred in one way or another to separate authorities—local authorities were suggested—I do think that reflects the failure of nationalization. I am not saying that nationalization has failed, but if that is done it will have failed. I think before such a decision is reached, before the advantages of unification are thrown away, we should have a public inquiry into the whole subject.

MR. L. N. MORTON: The speaker before last suggested that works should be sited on canals so that goods could be delivered to them straight from dock and ship. In 1934 and 1935 the company I was associated with had cause to investigate this position in Birmingham, and we found that over forty per cent of the works had actually got loading wharves hidden away behind corrugated iron which they had forgotten all about. The works were sited in the early years of the canal era for canal transport. That potential exists to-day.

If I might refer to what was said about canals being abandoned because the traffic was insufficient; surely if the Executive were controlling them and there was not enough traffic passing on canals to support them, the prime duty of the Executive would be to see that such traffic is found and carried on them.

MR. C. J. GALPIN, D.S.O.: I should just like to say apropos of the figure of seven and a half million for the maintenance of canals, mentioned just now, that the actual sum spent in the year 1950 on overcoming arrears—not keeping current canals going, but only overcoming arrears—was £375,000, which is only fifteen per cent of the current maintenance, and that is the rate at which, at the present time, we are attempting as a nation to put the canals in a proper state. I would like to compare that, if I may, with some other figures which seemed to suggest to me that the canal side of the Executive is less fortunate in getting money out of the Treasury than their confreres on the other sides. There was, for example, a very considerable sum, £733,000, given by the railways to ticket agents for selling their tickets, twice as much as was spent on putting the canals into order. There was £862,000 spent on railway publicity in 1950 and £865,000 in 1951; on canal publicity in 1950, £1,336 5s.

THE CHAIRMAN: We have had a most interesting discussion into which I myself do not propose to enter, except to say this, that the Chancellor of the Exchequer is responsible for a great deal, but he is not responsible for providing money for the Docks & Inland Waterways Executive. I think perhaps we might report from this meeting that his name has been cleared of that particular imputation. We have ranged very widely over almost the whole field. We have not gone into detail on any of the individual aspects of the problem, but I think we shall all carry away with us the conviction that there is, in the country, enormous interest in the canals, whether for commercial purposes or for pleasure purposes, or merely because they are beautiful and the country looks nice from them.

It has, I know, been a great pleasure to all of us to listen to Mr. Aickman, particularly when we did not agree with him, to hear of the very interesting work which his Society is doing, and to hear also of the success which has attended its efforts, particularly its success in attracting public interest as indicated by public money, which is much more difficult to obtain than interest. I am sure you would wish me, on behalf of all of you, to thank him very warmly for his paper this afternoon and to say how much we have enjoyed it and how grateful we are to him, especially as he himself has only just risen from a bed of sickness in order to deliver it.

*The vote of thanks was carried with acclamation; and, another having been accorded the Chairman, the meeting then ended.*

# PLANT HORMONES

*The Fernhurst Lecture by*

*S. C. HARLAND, D.Sc., F.R.S.*

*Professor of Botany, University of Manchester,  
delivered on Wednesday, 21st January, 1953,  
with Sir William Ogg, M.A., Ph.D., LL.D.,  
Director, Rothamsted Experimental Station, in  
the Chair*

THE CHAIRMAN: From its earliest days this Society has taken the very greatest interest in agriculture. By means of lectures, awards and demonstrations it has done more than is generally realized to encourage advances and promote improvements. This early assistance came at a very critical time, when agriculture was in a period of transition, and before the establishment of such bodies as the Royal Agricultural Society of England and Rothamsted Experimental Station.

Our Secretary, Mr. Luckhurst, has been delving into the history of our Society, and from what he has unearthed I would guess that, during the first century of its existence, agricultural improvement was its most active interest, and agriculture the industry which it helped most. The Society has never lost its interest, but naturally, when other organizations were set up specifically to foster improvement in agriculture, it devoted less attention to that industry. The agricultural activities of the Society, however, have received a fresh stimulus through the endowment in 1950 by Plant Protection Limited of the Fernhurst Lecture, to be devoted to the application of science to agriculture—a very notable endowment.

We are indeed fortunate in having as the Fernhurst lecturer to-day my friend Professor Sydney Harland, who has done much valuable work on plant genetics—particularly with the genetics of cotton. Professor Harland has worked in many parts of the world. I will not embarrass him by attempting to outline all his achievements; they are well known to most of you. He worked in the West Indies for many years; he worked in Manchester for a time in his earlier days; he worked in Brazil and in Peru; and, very happily, he has returned to this country to occupy the Chair of Botany at the University of Manchester.

Now, although he is best known as a cotton geneticist, he has much wider interests. For instance, he is a very eminent cytologist, and he has been greatly interested in and contributed to the theory of evolution. He has as you will gathered helped in the solution of many of the problems of tropical agriculture.

We look forward to what he has to say on this fascinating subject of plant hormones. The subject is a relatively new one, but it has made extremely rapid progress in the last twenty years, and it opens up most promising new vistas of knowledge as well as practical applications. In Professor Harland's own field of genetics I suspect it will prove a valuable tool.

I have very great pleasure in asking Professor Harland to deliver the Fernhurst Lecture.

*The following lecture was then delivered:*

## THE LECTURE

The subject of this lecture is the very general one of plant hormones. The word "hormone" has now got into the vocabulary of the man in the street *via*

the daily press, though not with any precise connotation. It is indeed difficult to talk about a subject without defining it, so I shall begin by being a little historical.

The term "hormone" was minted in 1902 by Baylis and Starling, and it is derived from a Greek word meaning "I arouse to activity". Hormones denote chemical substances secreted by the endocrine glands which, when carried by the blood stream to another organ, affect the functioning or activity of that organ.

Hormones have also been thought of as "chemical messengers". What do they do? To answer this question we must realize that all animals possess certain tissues and organs performing different functions, and carrying on special activities. The entire body has to work as an integrated and harmonious entity. No one part or tissue has to get out of step. Organs and tissues must therefore in some way be subject to a system of co-ordinating controls. These controls are, so far as animals are concerned, of two kinds. There is first the nervous system, which "may be likened to an intercommunicating network of telegraph wires centring in the brain, spinal cord and ganglia". Second there is a complex system of hormones or chemical messengers emanating from the endocrine glands which, by altering the activity of an organ, also affect the activity of others. The hormones act as a sort of balance wheel to enable the metabolic processes of the organism to function in an optimum way, and also to buffer or to minimize the evil effects of violent fluctuations of the environment. It will be sufficient to mention one or two animal hormones. Adrenalin or ephinephrine is a hormone secreted by the adrenal glands. In periods of stress brought on by fear, rage or hunger, there is a discharge into the blood stream of a much larger amount of this substance than usual. There is a rise in blood pressure and a general mobilization of bodily forces which enable the organism to meet the emergency.

Another hormone is insulin, which is secreted by the pancreas and has to do with sugar metabolism and with the control of the blood sugar level. Failure of insulin production brings about the disease known as diabetes, and the therapeutic use of insulin for this disease is now well known.

Animal hormones have now been studied for fifty years and a great deal is known about the chemical and physiological properties of the thirty or more which have so far been identified.

A plant is also an association of different tissues and organs which require the same kind of co-ordination as we have seen to be necessary in animals. Plants have no nervous system and any co-ordination must therefore be through other mechanisms. It can be shown that there are in plants chemical substances which are formed in one part of the plant; they pass to other parts; they produce special growth effects, and they are thus entitled to be known as plant hormones.

#### HORMONES AND ROOT GROWTH

An example of hormonal regulation in a plant is provided by the relationship between roots and leaves. By means of special techniques it is possible to grow excised roots in an aseptic culture medium. If this medium contains the right



substances in the right amounts, these isolated roots grow as fairly normal roots. The medium first employed was one containing a complete array of mineral salts, with added sucrose, to supply the carbohydrate normally transported from the leaves to the roots. In successive transfers of flax roots to fresh media it was found that growth became poorer with each successive transfer. The roots needed something for growth which they were either not getting at all or which they were making in too small an amount. The necessary substance proved to be the well-known vitamin thiamine, and it was needed in the very low concentration of one part to ten million. When supplied the roots grew well.

The nutritional requirements of tomato roots are somewhat different, and vary somewhat from strain to strain. Some strains need not only thiamine, but also pyridoxine, nicotinic acid, or both these substances.

How does the root obtain its supply of thiamine and other necessary substances? It can be shown by some simple ringing experiments that in the tomato plant thiamine accumulates above a stem girdle between the root and the stem, and also above rings at the base of the leaves.

Absence of thiamine from the nutrient solution produces characteristic symptoms. Cell division slows down and finally ceases. Thiamine is therefore a factor influencing cell division. It is also a factor influencing respiration. Pyridoxine is concerned with the synthesis of amino acids; nicotinic acid has to do with respiratory enzymes. All three substances thus play an essential part in the biochemical economy of the plant.

It has been known for many years that most animals including man require thiamine and other vitamins of the B complex as essential constituents of their food. These vitamins are made by plants, not to prevent deficiency diseases in animals or ourselves but for their own growth and well-being.

#### LEAF GROWTH HORMONES

Just as there are root growth hormones, there are also leaf growth hormones. If, for example, immature leaves of the pea plant are excised and placed in a nutrient medium containing the usual mineral salts and sugar, they grow very little. But if the amino acid adenine is added growth is promoted. Adenine thus functions as a leaf growth hormone in the pea plant. When tried with leaves of certain cereals, however, it was without effect. It is therefore likely that different species of plants need quite different substances to play the role of leaf growth hormones.

#### STEM GROWTH HORMONES

These comprise a series of hormones which are synthesized in the apical bud or young expanded leaves and then transported to the elongating parts of the stem. If you take a section from the growing region of a pea plant which has been kept in the dark, and place it in a nutrient solution containing mineral salts and sugar, there is practically no growth. But if a small amount of the substance IAA (Indoleacetic acid) is added, there occurs a very rapid elongation of the excised section.



This substance, IAA, is therefore proved to be instrumental in speeding up the growth of stem tissue. It works also in very low concentration, since only about ten parts per million are required to bring about the effect. Growth substances such as IAA and related compounds are known as auxins. Auxins are concerned not only with stem elongation but also with other growth co-ordinating processes within the plant. The main point to bear in mind is that the hormone principle is evoked to bring about a correlated and harmonious integration of the whole plant.

#### MORE INSTANCES OF HORMONE EFFECTS

We have so far seen that the growth of a plant organ such as the root partly depends on minute quantities of chemical substances transported from other parts of the plant. The techniques of tissue culture enable us to identify some of these substances.

It is now possible to grow the excised ovaries of tomato in a culture medium. The tiny ovaries are excised shortly after pollination and placed in a medium supplemented by the juice of either green or red tomatoes. This juice presumably contains substances necessary for growth which are probably transported to the ovary from other sites, but neither the sites nor the chemical nature of the substances are known. Lately it has been discovered that the substance NOA (naphthoxyacetic acid) acts as an adequate substitute for tomato juice. The cultivation of fruits in artificial media obviously has exciting possibilities for the future.

#### NUTRITIONAL NEEDS OF PLANT EMBRYOS

Minute and only partly developed embryos can be caused to develop by using an artificial culture medium supplemented by additional substances in low concentration. These include some vitamins of the B complex such as thiamine and pantothenic acid. Other unidentified compounds are known to be contained in yeast extract, malt extract, and coconut milk. The growth of mature embryos can be speeded up by addition to the medium of thiamine, biotin, nicotinic acid, and other special substances.

#### WOUND HORMONES

When wounds in plants begin to heal the formation of new tissues appears to be started by particular chemical substances liberated from injured cells. These wound produced substances may also be counted among the plant hormones. If a potato tuber is cut, the surface soon becomes covered by a layer of corky cells, but if the injured surface is washed just after cutting the layer of healing cells is not formed. One wound hormone has been isolated from injured bean pods. It is known as traumatic acid. It is not effective with tissues other than those of the bean and it seems likely that different species of plants are characterized by wound hormones of chemically diverse types.

To sum up: the growth of a plant is controlled and integrated by many growth hormones, each produced in a particular organ and transported to other organs

or tissues. A knowledge of these substances has thrown light on such old questions as the reason for the bending of plants towards light and the response of plants to gravity.

#### TECHNOLOGICAL APPLICATIONS OF PLANT HORMONES

It will have been noticed that the substances which we have postulated as fulfilling the original definition of a growth hormone are not usually thought of in this sense so far as the animal world is concerned. The animal physiologist would not regard thiamine as a hormone, nor would he consider the new antibiotics which promote growth in animals as falling within this category. The term plant hormone is now used in a much wider sense. Two American investigators define a plant hormone as follows: "a hormone is any organic chemical substance, naturally occurring or synthetic, which in very low concentrations affects growth or metabolism—at the site where naturally produced, or applied, as well as at sites to which it may be transported". If I discussed plant hormones in the restricted sense of the earlier use of the term, I should not be able to refer to the technological applications of what should more properly be called growth regulating substances, or more simply growth factors. For out of purely academic investigations on the phenomena of growth, largely carried out by plant physiologists, have emerged discoveries of the greatest importance to agriculture and horticulture. We are now embarking on a complete chemical overhaul in agricultural practice, and I hope now to outline some of these new developments.

The hormonal function of IAA (Indoleacetic acid) was first discovered in 1934. It was the first naturally occurring hormone to be identified, although Majima and Hoshino of Japan had synthesized it as early as 1925.

In 1935 Zimmermann and Wilcox announced the discovery of other organic synthetic substances with hormonal properties. The most important of these were: NAA (Naphthalene acetic acid); and IBA (Indolebutyric acid).

In 1938 Levine established that another substance behaves as a hormone: NOA (Naphthoxyacetic acid).

In 1942 Zimmermann and Hitchcock reported on the effects of yet another synthetic compound on plant growth: 2, 4-D (2, 4-dichlorophenoxyacetic acid).

In 1943 Zimmermann found that 2, 4-D induced hormonal responses in plants. These four synthetic hormones, all discovered within a period of eight years all produce hormonal responses, but to different degrees. Their discovery and commercial possibilities led to an enormous expansion of research in which the principal roles have been played by the research laboratories of the chemical industry, and by plant physiologists working in government experimental stations, in research institutes and to a minor extent also in universities.

The list of synthetic substances with growth regulating properties which can be used in agriculture and horticulture is now very large, and it would serve no useful purpose to refer to any of them individually. I must, however, stress the fact that twenty years ago the gardener or farmer of enquiring mind knew nothing about plant hormones. It is only in recent years that their exploitation

has become what our American friends like to call a multi-million dollar industry.

It will be of interest to enumerate some of the things which plant hormones can do, and for which they are used at the present time.

1. Control weeds.
2. Cause flowers to remain on a tree.
3. Cause flowers to drop off.
4. Produce fruits without pollination.
5. Prevent the formation of fruit.
6. Cause more fruits to develop.
7. Cause total or partial elimination of fruits.
8. Produce earlier fruits.
9. Produce later fruits.
10. Produce seedless fruits.
11. Produce fruits with more seeds.
12. Induce root formation (on cuttings).
13. Prevent the sprouting of tubers (potato).
14. Cause defoliation.
15. Enable difficult plant hybrids to be made.

This list is a formidable one, and it will be readily seen that these practices do represent an enormous advance in agricultural techniques and that we are veritably in the middle of an agricultural revolution. The late Sir Daniel Hall once said that there were only two major discoveries which science has made to agriculture: one of these was the discovery of artificial manures; the other was the discovery of the laws of Mendelian inheritance. I think that it may now be safely said that the discovery and proper use of growth regulating substances is a third major contribution which science has made to agriculture.

#### 1. *Weed control*

It will have been noted that the discovery of the hormonal properties of the substance 2, 4-D took place in 1942. By 1948 twenty-seven and a half million pounds of 2, 4-D were being manufactured annually for agricultural use in the United States, more especially for weed eradication or control. This substance is especially toxic in certain concentrations to broad-leaved weeds, and by spraying it inhibits the growth of these. Applied to the soil it prevents the germination and development of weed seedlings. The average rate of application is about one pound per acre, and it may therefore be estimated that in 1948 about twenty-five million acres were treated in the United States. The use of 2, 4-D is favoured by the fact that grasses and cereals are quite resistant except when young, and as broad leaved dicotyledons are very sensitive, this enables cereal crops and lawns to be freed from bad weeds of this type with relative ease; 2, 4-D is so potent that a few pounds of the chemical would be enough to affect the growth of the whole of most dicotyledonous crops in this country.

#### 2. *Prevention of pre-harvest drop of fruit*

The second largest outlet for the use of plant hormones is for the prevention

of pre-harvest drop in fruit. The weed killing substance 2, 4-D has also been used for this purpose, and also for accelerating the ripening of green bananas and apples. There are now many proprietary products on the market, but chemically they all appear to be naphthalene acetic acid (NAA) or a new substance, 2, 4, 5-trichlorophenoxypropionic acid.

Pre-harvest drop of apples has been a headache for the fruit grower for a long time, and one of the first uses of hormone sprays was to reduce this source of loss. NAA is applied as a spray at a concentration of ten parts per million or as a dust at 0.1 per cent. The time of application is just as soon as much dropping becomes evident. The substance 2, 4, 5-trichlorophenoxypropionic acid (2, 4, 5-TP) is effective in controlling fruit drop and is also said to improve colour. Varietal differences affect the efficiency of the particular chemical substance used. NAA does not work very well with some varieties whereas 2, 4-D has been a success.

Hormonal control of fruit drop in oranges is now a well established practice in California. This is of great practical importance as fruit drop formerly caused great loss of crop—amounting to as much as twenty-five per cent at the end of the season. Following the lead of the apple growers, spraying with NAA was first tried, but proved useless. However, the alternative substance 2, 4-D, previously referred to as a weed killer was found to work. It is applied as a water spray in the low concentration of only eight parts per million. In an oil-water emulsion the even lower concentration of four parts per million has been found practicable.

### 3. *Elimination of excess fruit*

The problem of how to deal with too much fruit in apples and other fruits has also been the subject of experiment. Hand thinning is of course an expensive operation. Here the same substance NAA is used at low concentration, and is applied at the flowering stage or shortly after.

### 4. *Hormones in horticulture*

#### (a) *Prolonging the blooming period.*

The use of hormones in horticulture is now widespread for a great variety of purposes. They will prolong the flowering period of such trees as the flowering cherry (*Prunus spp.*).

In periods of warm weather the flowers open rapidly and shed quickly, and spraying with NAA or allied compounds will cause the flowers to stay on the trees much longer. The spray should be applied when most of the flowers are fully open. Not all ornamental trees respond to treatment. Azaleas do not respond, nor do crab apples, flowering quinces or magnolias.

#### (b) *Preventing holly leaves from dropping.*

NAA is highly effective at a concentration of 20 parts per million.

#### (c) *Preventing fruit production in flowering trees.*

Several compounds are used, depending on the species involved. NAA works

with some species (e.g. horse chestnut) but not with others (some types of purple crab apple).

A compound so far not mentioned, maleic hydrazide was found to prevent the fruiting of the maidenhair tree (*Ginkgo biloba*).

(d) Rooting of cuttings.

It is common knowledge that some plants can be grown very easily from cuttings and others not at all. Hormones can be used to hasten rooting and to increase the number of roots formed in a given time, but they will not cause roots to form on material that normally does not root, nor can the use of hormones replace horticultural skill. There are many synthetic products in commercial use and these are mainly IBA (indolebutyric acid) and NAA (naphthaleneacetic acid) together with related compounds.

(e) Producing fruits without pollination.

If you plant a holly tree in your garden you may not get any fruits. This is because some trees are males and cannot fruit, or because the tree is a female and there is no male near at hand to supply pollen. A hormone spray will induce abundant setting of fruit, not only in holly, but also in tomatoes, fuchsias, and many other plants.

Seedless tomatoes can now be produced to order by using a large range of compounds. Indolebutyric acid is recommended, but there are now many others.

On a small scale spraying can be done with a hand atomizer. The spray is applied when the flower is fully expanded and repeated applications are necessary throughout the season at intervals of about a week.

(f) Preventing potato and stored nursery stock from sprouting.

Large-scale users of potatoes have suffered heavily in the past from premature sprouting. The potatoes are usually stored at a temperature of 40°F. or somewhat higher, and much sprouting is evident after a few weeks' storage at this temperature. Hormone treatment can be used for inhibiting the growth of sprouts. A good method for the small gardener is to use a handful of confetti impregnated with hormone to each bag of potatoes. The hormone used is naphthaleneacetic acid in the form of its methyl ester.

It is often necessary to store various plants such as young fruit trees and roses for relatively long periods of time, especially in spring. Many plants sprout after a short rest period and use up their food reserves. Then when planted out they either fail to survive or grow very slowly. The same hormone which is used for potato sprouting can also be used for roses and young fruit trees.

*Hormones and the pineapple industry of Hawaii*

The pineapple industry of Hawaii is probably the most efficient agricultural large-scale enterprise in the world. It is therefore not surprising that the fullest advantage is taken of the immense possibilities of plant hormones for the control of growth.

Hormones are used to bring varieties into flower at convenient times. Some varieties are slower to flower and take as long as five years. An old practice was to smoke the plants by means of large bonfires, using tents to confine the smoke.

The current practice is to spray with NAA at a concentration of about one ounce per acre using large power sprayers. Only one application is necessary. The advantage of uniform flowering is very great since before hormone spraying came into use, the crop extended over a period of several months. Now that the whole field can be made to flower at once, all the plants fruit over a very short period. Uniformity of fruiting means increased yields, and exact timing of picking in different fields is now possible. As soon as one field is finished another is just ready for picking.

An interesting sidelight is that NAA induces a very long and weak stem. Another hormone is used to counteract this. Spraying with betanaphthoxy-acetic acid delays the ripening of the fruit, increases its size, and at the same time strengthens the stem.

*The use of hormones for making difficult plant hybrids*

Hybridization between varieties within a species is usually easy. Hybridization between different species in a genus is more difficult and depends very much on the genus and on the species. Some species crosses are easy and others difficult or impossible.

One frequent cause of lack of success is the fact that even if one or two seeds do result from the application of pollen from a different species, the fruits drop off or do not mature. Or the pollen tubes grow so slowly that the flower drops off before fertilization is effected. Many new hybrids, formerly considered to be impossible, have now been made with the aid of plant hormones.

Rick in California has even succeeded in crossing the tomato with a wild species of *Solanum* native to Southern Peru. He used the substance parachlorophenoxyacetic acid in a concentration of 0.01 per cent in lanoline.

THE FUTURE OF PLANT HORMONES

It will be apparent from the short account which I have given of the current position of the use of hormonal regulators of plant growth, that spectacular progress may be expected in the future. In my own field of interest, which is mainly that of breaking the present barriers to crossing representatives of different genera, it is apparent that we are in the beginning of a new era of untold promise. A large number of hitherto intractable species combinations have been made though few workers are employed in this field. The control of some important plant diseases and insect pests can best be done by incorporating resistance genes from allied species and genera. The scope of plant breeding is thus greatly enlarged by these new perspectives.

With regard to weed control it is likely that the newer methods of chemical and hormonal control will result in far reaching changes in agricultural practice. The planting distance of maize at present is about 42 in. by 42 in; the check row system has been evolved to permit of weed control by cultivating both ways. If pre-emergence soil treatment could control weeds effectively—and we seem well on the way to this—the planting distance could be reduced, and the yield probably increased by a more intensive cultivation of the soil, permitting the use of more fertilizer.

From the standpoint of the plant physiologist it would seem that the characters of plants are not so fixed as was thought. If the flowering time of grasses could be delayed it might be possible to maintain a permanent leafy sward, and radically change the composition of the crop for feeding purposes.

Other modifications may be expected. Delayed flowering and quicker maturity may permit plants to be grown outside of their normal climatic zones, and the production of parthenocarpic fruits—seedless fruits—will certainly increase. Already almost the whole of the fig industry of California has gone over to seedless fruits, and this is the only industry which has so far done so. There is some evidence that hormone produced fruits may be different in chemical composition from those naturally set. It is reported that seedless tomatoes are sweeter.

At present the field of application of this new chemical knowledge is being restricted by lack of fundamental knowledge of the precise way in which they act. Additional uses will certainly be found for the new chemical substances which are now being turned out in ever increasing quantities.

All the facts which have been mentioned concern the phenomenon of growth—of the factors which control the velocity and regulation of cell division. A study of growth is an exploration of the most fundamental of the properties of living matter of the whole organic world. It is in this study that the points of view of workers in many varied disciplines will coalesce. Any new facts about growth in any organism may profoundly affect knowledge about man himself. The biochemistry of the behaviour of the excised roots of groundsel may seem unconnected with fundamental problems of human disease, but the biochemistry of life comprises an integrated and interlocking series of interrelated facts, and any fact about one organism may tie up in quite an unforeseen way with another fact about another organism. "They also serve who only stand and wait" applies to facts as well as to individuals.

## DISCUSSION

THE CHAIRMAN: In throwing this meeting open for discussion, I should like to refer to one of the interesting applications of research on hormones with which our lecturer has dealt, namely, the research on hormone weed-killers. My own first knowledge of this was during the war when I came to Rothamsted; I found that Nutman, Thornton and Quastel were working on it, but I was sworn to secrecy. Because of the possibility of its being of use to the enemy, this work was not published until 1945. Simultaneously, there was published work which had been going on independently by Slade, Templeman and Sexton at I.C.I., and by Blackman, who at that time was at the Imperial College of Science and Technology. The necessary secrecy resulted, I feel, in this work being somewhat overlooked, and in the American work receiving rather more attention.

I see that Dr. Thornton and Dr. Templeman are both here to-day. Perhaps they would like to say a word about it.

H. G. THORNTON, F.R.S. (Rothamsted Experimental Station): The work that Dr. P. S. Nutman, Professor J. Quastel and I did at Rothamsted in 1941-42 was interesting as an example of the unexpected developments that may come from a field of work that appears specialized and academic. Our work arose from a study



of the infection of clover roots by the nodule-forming bacteria (*Rhizobium*). These bacteria were known to infect the roots through the unicellular root hairs. It was also known that they produce a characteristic curling or deformation of the root hairs which is a necessary prelude to infection, and that this deformation could be produced by sterile filtrates from cultures of the bacteria. There was evidence indicating that the active substance in the secretions was  $\beta$ -indolyl acetic acid. To confirm this indication we tried the effect of this compound at different dilutions on clover seedlings grown aseptically and found that it did deform the root hairs at very high dilutions. But we also found to our surprise that at a dilution of one in a million it killed the clover seedlings. We then tried the effect of  $\beta$ -indolyl acetic acid in fresh soil but found it inactive, no doubt because it is readily decomposed by soil bacteria.

At that time 2,4-dichlorophenoxyacetic acid was already known from American experiments to have a plant hormonal activity. We thought its toxic effects in soil worth testing because it was a molecule containing chlorine more likely to be resistant to microbial attack. We tried it first on clover and then on sugar beet and wheat, and found it was toxic to clover and beet at a dilution of one in four million of the soil, but that at this dosage it had no effect on wheat.

Further work on this subject was pursued by Doctors Slade, Templeman and Sexton, who were also investigating hormonal compounds as herbicides and with whom we later co-operated. By the time that publication was possible after the war, research was well under way in a number of places.

DR. W. G. TEMPLEMAN: In response to the Chairman's request, it is a pleasure to recall the early days of this work. May I add that it has also been with great pleasure that I have listened to Professor Harland this afternoon. I remember that in 1936 I gave a talk on this subject, and it is extremely interesting to see how this field has developed over the last seventeen years. Very little which Professor Harland has mentioned this afternoon could have been said then.

We were particularly interested at that time in the properties of organic matter as applied to or as found in the soil. With the discovery of  $\beta$ -indolyl acetic acid and the possibilities of synthetic materials with similar properties, we were interested to know whether in fact the growth of plants could be increased by their use. It was from experiments designed to discover whether this could be done that the selective depressing effects of some of these growth substances were first noticed at Jealott's Hill. We then joined forces with the chemists, and the substituted phenoxyacetic acids were found. We later joined up with Doctors Nutman, Thornton and Quastel and Professor Blackman during the war.

There are perhaps two other things I might contribute to this discussion. The first is that you will have noticed that Professor Harland very carefully adopted the widest of definitions in his use of the words "plant hormones". It may be of interest to the meeting to know that the American Society of Plant Physiologists have been considering this matter of terminology for the past two years, and after long study have been able to issue a little pamphlet for further consideration by their colleagues at home and overseas. This is a very complex matter, but I bring it to your notice, because Dr. van Overbeek (P.O. Box 1531, Modesto, California) would, I am sure, furnish copies to any body who is interested in this aspect of the subject.

The second is that we have been looking through the list of compounds which we know have, or are said to have, plant growth regulatory activities. The number now is certainly very large and it is going to grow. There is quite efficient screening work going on in many laboratories in the world. We may expect from that work many new compounds to come forth, probably with very different properties from those which we know at present. So I should like to emphasize and underline Professor Harland's request that there should be a deepening and widening of the fundamental work in this field.



DR. E. HOLMES: I should like to make three comments. The first is to congratulate Professor Harland on giving us such an excellent summary of the development of our knowledge of the subject in the last twenty or twenty-five years.

Secondly, he very properly pointed out the extremely large use of these chemicals in agriculture. He indicated that something like 13,000 or 14,000 tons of 2,4-D was used in America, I think he meant last year. But I do not think it is quite appreciated that, although all the other uses to which he made reference are very interesting technically, probably a few pounds, a few hundredweights, not more than a ton or so, would satisfy all other commercial requirements of the hormone products apart from weed-killers. Weed-killers are by far the most important in world chemistry.

The third point I should like to make, something I think Professor Harland could have mentioned, is that Dr. Terapleman himself discovered in 1941 the weed-killing possibilities of MCPA; 2, 4-D was discovered by him in 1942. I should like to draw attention to the fact that, although 2,4-D is used almost exclusively for this work in the United States and Canada, in this country by far the greater proportion of the work is done with MCPA. The benefit from a weed-killer of this type is the difference between the increase in cereal yield due to the removal of competition for soil moisture and plant foods, and the adverse effect of the chemical directly on the host crop. In our experience, where there are differences between the two in effect on the host crop, MCPA is always safer than 2,4-D. That is why much recent American work is being done with MCPA, although the raw materials are handier for 2,4-D. They are having second thoughts about yields now.

DR. L. M. J. KRAMER, M.A., F.L.S. (City of London School): I wonder if I might be allowed to make a few comments from an educational angle. I know this is primarily a scientific and agricultural discussion, but the society in whose imposing premises we have the pleasure of meeting serves a wide number of interests, including education.

It may be a very exciting thing to live in a scientific revolution, as we are doing, but it does bring very considerable complications for those of us whose task it is to present science to the young in a course of general education. I am not talking now particularly of teaching the gifted person who may become ultimately a distinguished scientist of the kind we have had the privilege to hear to-day. Our problem is partly to try to keep our teaching reasonably up to date, and partly to eradicate common misconceptions. I would ask the lecturer for information about some of the experiments that demonstrate the existence of these hormones. One of our problems, of course, is to have a simple but irrefutably clear demonstration of a principle. If we can do that, we have gone a long way to correcting misconceptions, and we have gone a long way to establishing an understanding of scientific principles. But the demonstration must be simple, and it must be lucid. The young mind at fourteen or so is quite critical, despite what a lot of people may think. I thought I had demonstrated most convincingly the other day that solids expanded under the influence of heat, and I was met by one of my pupils next day with, "I was impressed by what you showed me, Sir, and I heated a measured piece of wood when I got home last night, and it shrank. I should like you to tell me how you reconcile this result with your lesson".

I feel it would be very helpful to us if the lecturer could tell us whether it is possible that some of the fundamental experiments, for example sterilization and isolation of root tips, and their growth in two solutions subsequently, one with and one without the necessary substance to promote normal growth, might be simple enough to come within the resources of a school laboratory. It is possible, for example, in school laboratories, to demonstrate not only the bacteriostatic but also the selective action of penicillin against different types of bacteria. It is within school resources and is

a demonstration with striking influence upon the pupils' minds. Is it possible to do something along the same lines with plant growth regulating substances? It would be particularly important if we could do that, because we are restricted greatly in experiments as distinct from observations upon living animals.

THE LECTURER: I am rather reminded of a remark made to me by a colleague of mine. I went down to see the biology laboratory of a very well-known public school and found that they were making plasticine models of chromosomes and working out the constitution of Vitamin B<sub>1</sub>. My friend said to me: "Of course, when they go to the university, they will know more than the professors!"

With regard to the particular question that was asked, the technique of excised roots is pretty well a bacteriological one, using ordinary common bacteriological techniques: schedule of instructions, the correct sort of sterilizing agent, the time factor, the exact way in which you take off the excised root. I think it could be done in schools. I think this experiment could be demonstrated fairly easily.

Other experiments could be made. I think the *avena coleoptile*—the young oat—can be caused to respond to various hormonal agents. It can be caused to exhibit bending. That could be tried.

All of us, I think, ought to do our best to bring these new matters within the experimental reach of intelligent pupils who are biologically inclined. I feel that the syntheses between these various lines of investigation are things that schools could understand and get very excited about. I myself was able a few days ago to turn a boy in the direction of biological experimentation, merely by telling him about a recent discovery rather along these lines in America. An investigator called Kidder was working on the nutrition of an obscure species of protozoa. He found it needed a substance called Guanidine to grow. It was quite unique. Then he thought he would supply it with an allied compound. He did this and found it would not grow at all; it was confused by the new substance; it took it up but it could not make use of it biochemically. Then it occurred to him to try this allied substance on tumour growth in mice. He injected this substance into mice and found that it stopped the growth of tumours, simply because the tumourous tissue of the mouse required Guanidine, whereas the normal tissues did not. The moral from that is that research on the growth and growth substances of an obscure species of protozoa probably resulted in a greater advance in our fundamental knowledge of how to tackle some aspects of cancer than all the millions of dollars that have been put into cancer research.

That is just to give you another example of how knowledge can come from perfectly unexpected directions. It is, of course, fairly obvious that the development of plant physiology may in future be very much along these lines. You can, for example, grow excised callus tissue of some plants in artificial culture media. At first they may need the plant hormone, IAA. After a few generations a change takes place, and sometimes they are found not to need it any more. This kind of change very often takes place in tumour tissue resulting in a different set of biochemical properties and different growth requirements.

All these sorts of facts, I think, would be quite within the province of biology teachers in schools to tell their pupils. I believe great benefits would result. They would be stimulated. After all, all boys really want to know what is going on in the modern world. They do not want to be fifty years behind the times.

DR. C. R. METCALFE, M.A. (Jodrell Laboratory, Royal Botanic Gardens, Kew): It is with some trepidation that I venture to make any remarks this afternoon, as it is now some years since I have done any work with plant hormones. Before the war I was associated with Dr. Templeman, at Kew, in the use of these substances for propagation from cuttings. At that time I noticed a fact which I do not think has yet appeared in print, but which is important, namely that those cuttings which will not respond to treatment with these synthetic growth-regulating substances are

anatomically dissimilar from those which will respond easily. The amount of fibre in the stem has a very pronounced effect on the ease with which cuttings will respond; as has also the position of the cork formation; and thirdly, the plants which have secretory cells in their stems respond less readily than other types of plants.

I am afraid I cannot offer any full explanation of why those things should be, but I do feel they are subjects which would be well worth following up further at some time in the future.

There is one rather different point on which I should like to hear what Professor Harland has to say. It cannot have escaped anyone's notice that there have been very serious smoky fogs this year; and those smoky fogs have had a deleterious effect on many of the plants at Kew. They have shed their flowers, they have shed their leaves; and many of them have been completely ruined, particularly begonias, orchids, and so forth. Now, as Professor Harland has pointed out to us that it is possible to make flowers and leaves stay on plants when we want them to do so, I am wondering whether it would be possible to devise any hormone solution which could be applied to plants which are liable to be damaged in foggy weather, which would prevent these harmful effects from making their appearance. For although there are not a great number of plants growing in smoky areas, I feel that for places like Kew it is of the utmost importance that we should find ways and means of keeping our winter flowering plants in as good health as possible.

THE LECTURER: I am afraid I do not know the answer to that one. We have been doing a lot of work in Manchester on the effects of atmospheric pollution on plant growth. We have probably done more than anybody else in this country. Of course, we run up against the phenomenon of the shedding of leaves and flowers; the problem of fog is probably even worse in Manchester than it is in London. We are getting round now to trying some of these things which have been a success in general horticulturally, for instance in preventing the dropping of holly leaves. We do think it is worth while to pursue investigation, but at present there is nothing to report.

MISS MARY D. GLYNNE, D.SC. (Rothamsted Experimental Station): Might I ask one very practical question: has the lecturer much knowledge of how these hormones affect the flavour, the vitamin content, and that elusive thing known as quality, of fruit?

THE LECTURER: Investigations are proceeding, but not a great deal of exact knowledge is available. All the evidence so far is that there is no special change. Chemical composition can be influenced to some extent in the direction of a higher sugar content of the fruit, which is an advantage in some cases, although perhaps not in others. With regard to the seedless figs in California, as far as my knowledge goes there is no marked difference. But it is fairly obvious that the chemical composition of fruits can be changed. I do not know anything about the vitamin content; I imagine it is not affected. What is affected is the rapidity of maturity. If you can make the fruit stay on a longer time, naturally it can probably accumulate a few more chemical substances in larger quantities than before. I think so far the evidence is rather favourable to the use of the hormones. It is said for example that the use of 2,4-D in cereals slightly increases the protein content. I do not know whether that has been confirmed, but the statement has been made.

MR. H. P. ALLEN, B.SC., PH.D. (Senior Botanist, Plant Protection Limited): I should like to ask Professor Harland two questions concerning weed control. The first one concerns the fundamental aspects with which we have not had much experience. In the field although we are gradually feeling our way, we are well ahead of fundamental research in weed control. Dr. Templeman has referred to the question of sorting tests. I have often wondered whether perhaps we might

make some more direct progress in certain directions, particularly with regard to control of what are known as resistant weeds, if we were able to give more detailed study to the particular weed plants in question, such as bracken, which is a national economic problem and against which no chemical control has been discovered as yet. I wonder what Professor Harland's views would be on the advantages likely to accrue from detailed study of particular plants from our point of view, that is from the viewpoint of susceptibility to herbicides.

My second question concerns wild oats among cereals, which, we are told, appear to be on the increase. I was intrigued to hear a remark made by Professor Harland to the effect that there are certain plant hormones which will induce dormancy, for example in roses. It has often occurred to us that it would be a very good thing to have a hormone to enable us to break the dormancy period of the wild oats in the soil, and cause the weed to germinate earlier than normal, thus enabling us to get at it before the crop is sown. As things stand, even pre-emergence weed-killing techniques are useless against this weed.

THE LECTURER: If you could get seeds to have their dormancy broken, and if they could be induced to germinate immediately, 95 per cent of the battle would be won. That really would be an agricultural revolution greater than the one I have pointed out. It does not seem as if we are too far away from a solution, because a lot of work is being done on dormancy, though perhaps not with special reference to hormones. But the phenomenon of dormancy varies so much from plant to plant that, if you take a dozen different species, the seeds may be dormant for many different specialized reasons, and a treatment which would work with one would not work with another. The remedy seems to me, again, fundamental work on the growth physiology of the plants in question. As I said in the lecture, what we really lack is precise knowledge of the way the things act.

With regard to bracken, this has been under consideration from many angles, both physiological and otherwise; and so far nobody has any answer at all to the bracken problem—except that you should get after it!

THE CHAIRMAN: It is now my pleasant duty to thank Professor Harland. As I mentioned in introducing him, he is a man of very wide interests, and I think only a man of wide interests could have done justice to this subject. It could have been made very unpalatable by the introduction of too many details and too many long words. Professor Harland has avoided both, and has made the lecture, to me as a layman in this field, most fascinating. Sir Daniel Hall remarked that there had been two agricultural revolutions, and Professor Harland's suggestion that this may be a third I think is justified. When you think that the same group of substances can kill weeds, prolong the blooming period of flowering plants, enable fruits to be produced without pollination and prevent them falling off the tree—to say nothing of other things such as preventing potatoes sprouting when you store them, and facilitating hybridization—it may justifiably be called a revolution.

I should just like to add one more remark. Farmers are said to be the most conservative people in the world (I am a farmer myself); and is it not remarkable that in a period of a few years they have adopted many of these new discoveries and are using them to such good advantage?

It only remains for me, on behalf of the Society and on behalf of the guests who are present here to-day, to congratulate Professor Harland on his most interesting lecture, and to thank him for it.

*The vote of thanks was carried with acclamation.*

MR. A. R. N. ROBERTS: Before the meeting disperses, I am sure it would be the wish of this audience that we should convey our thanks to the Chairman on this

occasion. It is sometimes said, if a person is very pleased, that "he is as pleased as a dog with two tails". Perhaps on this occasion I might venture to claim that I am a dog with two heads. And in so far as I am capable of thinking in my capacity of a Vice-President of the Royal Society of Arts, I should like to express our pleasure, that the long tradition of the Society's association with agricultural science is so well maintained to-day, in that we have the Chairman as a member of our Council, not only to preside on such occasions as the present, but to guide us in all matters relating to our connection with agriculture. And in so far as I may add a word in my capacity of director of the company which has had the privilege of endowing this series of lectures, we are doubly indebted to him. He himself gave the third Fernhurst Lecture, and he has presided this afternoon at the fourth.

For two notable services, Sir, I tender to you, on behalf of everyone present, our most cordial thanks.

*The vote of thanks was carried with acclamation, and the meeting then ended.*

## GENERAL NOTES

### THE DAILY MAIL IDEAL HOME EXHIBITION, 1953

The Ideal Home Exhibition is such a well-established institution that to have lived some forty years in London and not to have visited it is to be out of the culture-pattern. This year, therefore, I visited it twice; once to view the whole spectacle as an entertainment, and a second time, more scientifically, to judge it as a demonstration centre for the consumer wishing to exercise intelligent choice before purchase. I came away from both these visits with an enormous respect for the endurance and good will of the public (though with some impatience at its uncritical acceptance of whatever is provided), but without any clear idea of the purpose of the Exhibition.

Judged by aesthetic standards the Exhibition fails. There is no central theme or dominating pattern. There is no fun, no interesting lighting or use of colour. The exhibitors seemed to have learned nothing from the South Bank nor from the new museography; the whole effect is the lowest common denominator of the window-dressing of the exhibitors. It is true, as I found, that Olympia, with all its halls, is too vast for one impression to be either created or received. Only the individual parts can make any impact. And how dull they are!

The second visit was made with certain definite and limited objects in view. I was comparing electric cookers, sink-units, and other kitchen equipment, and armchairs with leg-extensions.

Only when one begins to look for chairs or other specific articles of furniture does one begin to understand how the show is conceived. It is as though one visited a large library where both the books and the catalogue, beyond a simple breakdown into a few main categories (reference books; lending books, fiction and non-fiction; children's books) were all arranged by author. If you wanted a book on carpentry only luck and indefatigability would enable you to find it, unless you already knew the author. So with the Exhibition. There are sections for furnishing and decoration, household services, building sundries and domestic labour-saving. But if one wishes to see Formica surfaces, and does not know the maker's name, the catalogue indexes give no help. One can only keep on walking.

If by pertinacity one discovers what one wants, one may find that questions about performance and construction are not considered cricket, either by the demonstrators or by the public. And this is true of quite easily answered questions; for instance: "Are the eye-level grills on the new gas-cookers all of one height?" A fair question surely, when the customers' eye-level varies through about eight inches.

There are, of course, some useful and admirable exhibits. I liked particularly the all-purpose electric cook's helps that beat as they mix as they squeeze; the new plastic emulsion paints; the Formica tops which can now be attached to one's existing tables, and many of the smaller gadgets. And someone has had the ingenuity to combine two invaluable articles, the shopping basket on wheels and the miniature porter's trolley for one's suitcase. The furniture in general is sadly lacking in invention. All the materials which would make new designs possible exist, but the same old shapes, wasteful of space, dominate the scene.

This Exhibition was founded before Londoners had the Building and Housing Centres; if it is not soon reformed the public may begin to ask why they should pay to be advertised at, when the Exhibition's ostensible function is better performed elsewhere. But probably this is wishful thinking; no doubt it will always be the same, and always as crowded.

BARBARA KYLE

#### A CHEMICAL SOCIETY AWARD

The Chemical Society has announced the offer of its Corday-Morgan Medal and Prize for 1952. This award consists of a Silver Medal and a monetary prize of 150 guineas. It is made annually to the chemist of either sex and of British nationality who, in the judgment of the Council of the Chemical Society, has published during the year in question the most meritorious contribution to experimental chemistry and who has not, at the date of publication, attained the age of thirty-six years.

Copies of the rules governing the award may be obtained from the General Secretary of the Chemical Society. Applications or recommendations in respect of the award for the year 1952 must be received not later than 31st December, 1953.

#### CARPET DESIGN COMPETITION

The result of the Fleischman International Carpet Design Competition, which was mentioned in the *Journal* of the 16th May, 1952, has been announced. There were 600 entrants, of whom two thirds were from the United States. The first and second prizes were won by Leo Woller, of Vienna, and a Londoner, Louis de Brocquy gained an honourable mention.

The Jury, consisting of authorities in art, interior design and carpet manufacture, in making their selection looked primarily for originality, colour harmony and practicability. A number of good solutions to the problem of producing a carpet design, and not just a plain colour, suitable for a purely contemporary home, were provided.

### OBITUARY

#### THE RIGHT REV. C. D. HORSLEY

We record with regret the death, on 11th March, of the Right Reverend Cecil Douglas Horsley, Lord Bishop of Gibraltar, at the age of 49. After beginning his career at the head office of the Royal Mail Steam Packet Company, Horsley studied theology at Westcott House, and was ordained to a curacy at Romsey Abbey in 1929. In 1938, after two intermediate appointments, he was consecrated Bishop of Colombo. He became honorary senior chaplain to the Ceylon Defence Force in 1939, and officiating chaplain to the Imperial Forces in 1942, and held both these appointments until 1947 when he was translated to the see of Gibraltar, a diocese covering most of Southern Europe. He later became Dean of the Collegiate Church of St. Paul, Valletta, and Chaplain and Sub-Prelate of the Order of St. John of Jerusalem.

Horsley became a Fellow of the Society in 1944, and as Bishop of Colombo was in close touch with the Council for some years in connection with the Competition of designs for the new Colombo Cathedral which the Society organized at his request.

## LIBRARY ADDITIONS

## REFERENCE WORKS

- THE ENCYCLOPÆDIA of British Empire postage stamps, 1661-1951. Vol. 1, Great Britain and the Empire in Europe. 2nd ed. *Robson Lowe Ltd.*, 1952.
- LUCAS, EDNA LOUISE. The Harvard list of books on art. *Cambridge, Mass., Harvard University press*, 1952.
- NUNN, GEORGE WALTER ARTHUR, *editor*. British sources of photographs and pictures. *Cassell*, 1952.

## LIBRARIES, MUSEUMS AND SOCIETIES

- VICTORIA & ALBERT MUSEUM, London. The history of the Victoria and Albert Museum. *H.M.S.O.*, 1952.

## EDUCATION

- SPENCER, FREDERICK HERBERT, and INGRAM, BERESFORD. The art of the part-time teacher. 2nd ed. *Pitman*, 1952.

## SCIENCE

- COOMBS, ROBERT A. H. Mountain birds . . . *Penguin books*, 1952.
- KARO, DAVID. Electrical measurements, and the calculation of the errors involved. Part 2. *Macdonald*, 1953.
- MOUNSEY, JOHN. Introduction to statistical calculations. *English Universities press*, 1952.
- PORTMANN, ADOLF. Animal forms and patterns: a study of the appearance of animals. *Faber*, 1952.
- RODDA, S. Photo-electric multipliers. *Macdonald*, 1953.

## AGRICULTURE AND GARDENING

- FUSSELL, GEORGE EDWIN. The farmer's tools, 1500-1900: the history of British farm implements, tools and machinery before the tractor came. *Andrew Melrose*, 1952.
- GARDENS AND GARDENING: the *Studio* garden annual; *editors*, F. A. Mercer and Roy Hay. Vol. 4, Rock, wall and water. *Studio publications*, [1953].

## ENGINEERING, TRADE AND INDUSTRY

- HADFIELD, CHARLES. British canals: an illustrated history. *Phœnix house*, 1952. (Presented by Mr. Armand Felix.)
- PARKER, JOHN BURGESS. Banking. *English Universities press*, 1953.

## INDUSTRIAL AND COMMERCIAL ART AND DESIGN

- BLAND, DAVID. The illustration of books. *Faber*, 1952.
- DARMSTADT. Darmstädter Gespräch, 1952. Mensch und Technik, Erzeugnis—Form—Gebrauch. Herausgegeben . . . von Hans Schwippert. *Darmstadt, Neue darmstädter Verlagsanstalt GmbH*, 1952.
- GRAPHIS ANNUAL, 1952/53, international advertising art . . . *Editors* . . . Walter Herdeg, Charles Rosner. *Zurich, Amstutz & Herdeg, Graphis press*, 1952.
- HALD, ARTHUR, and SKAWONIUS, SVEN ERIK. Contemporary Swedish design: a survey in pictures . . . *Stockholm, Nordisk rotogravyr*, 1952.
- JACOBSON, EGBERT, *editor*. Seven designers look at trade-mark design. *Chicago, Paul Theobald*, 1952.
- MUMFORD, LEWIS. Art and technics. *O.U.P.*, 1952.
- THE STUDIO. Book of alphabets. *Studio publications*, 1953.
- TURNER, ERNEST SACKVILLE. The shocking history of advertising. *Michael Joseph*, 1952.



## FROM THE JOURNAL OF 1853

VOLUME I. 25th March, 1953

## From Answers to Correspondents: The Smoke Nuisance

Your Correspondent (No. 49) seems to be in error with reference to the Smoke Nuisance. A clause (No. 112) was introduced into the City of London Sewers Act, 11 Vict. 1847 and 1848, and one in a similar Act, 14 and 15 Vict. 1851, by which it is enacted, "That from and after the first day of January, 1852, every furnace employed or to be employed in the working of engines by steam, and every furnace employed or to be employed in any mill, factory, printing-house, brew-house, bake-house, etc. . . . or other buildings used for the purpose of trade or manufacture within the City, although a steam-engine be not used or employed therein, shall in all cases be constructed or altered so as to consume the smoke arising from such furnace, and if any person shall, after the first January 1852, use any such furnace, which shall not be constructed so as to consume or burn its own smoke, without using to the satisfaction of the Commissioners the best practicable means for preventing or counteracting such annoyance, every person so offending shall forfeit and pay a sum of not more than 51s. nor less than 40s. for, and in respect of every day during which or any part of which such furnace or annoyance shall be so used or continued". These Acts are not general, having been introduced by the City Corporation, who could only as a body ask for an Act to apply within their own jurisdiction. As a curious circumstance connected with this subject, I may mention, that while Messrs. Calvert, brewers, being in the city, are required to use means that the smoke of their furnaces shall be consumed, within a few yards on the Thames, innumerable small steamers, and Messrs. Barclay the brewers, on the opposite bank of the river, may pour forth into the atmosphere without molestation whatever quantity of carbon they may find convenient. The Commissioners of City Sewers will immediately attend to any case your Correspondent may point out.

W. S.

*Some Meetings of Other Societies*

MON. 23 MAR. Imperial Institute, S.W.7. 5.30 p.m.  
K. G. Bradley: *The Colonial Empire: Colonial Prospect.*

TUES. 24 MAR. Chadwick Trust, at University College,  
Gower Street, W.1. 5.30 p.m. H. R. Oakley: *Public Health Engineering: Research and Training.*

Manchester Geographical Society, 16, St. Mary's  
Parsonage, Manchester, 3. 6.30 p.m. W. A. Deer:  
*Mountain Building.*

Petroleum, Institute of, 26, Portland Place, W.1.  
5.30 p.m. J. B. Matthews, J. H. T. Brook, H. C.  
Evans, J. Hughes and R. P. Taylor: *The Examination of Used Lubricating Oils.*

Wool Education Society, at the Royal Society of  
Arts, W.C.2. 7 p.m. Miss E. M. Carus-Wilson: *Wool in the Economy of Medical England.*

WED. 25 MAR. British Foundrymen, Institute of, at the  
Waldorf Hotel, W.C.2. 7.30 p.m. D. H. Potts:  
*Match Plates.*

British Kinematograph Society, at Film House,  
Wardour Street, W.1. 7.15 p.m. G. T. Symington:  
*The Application of Television for Underwater Use.*

Electrical Engineers, Institution of, Savoy Place,  
W.C.2. 5.30 p.m. M. W. Humphrey Davies and  
G. R. Slenon: *Transformer-Analogue Network Analysers.*

Eugenics Society, at the Royal Society, Burlington  
House, W.1. 5.30 p.m. Gertrude Willoughby:  
*Population Problems and Family Policy in France.*

THURS. 26 MAR. Electrical Engineers, Institution of,  
Savoy Place, W.C.2. 5.30 p.m. S. W. Broadhurst and  
A. T. Harmon: *Studies of Telephone Traffic with the Aid of a Machine.*

Structural Engineers, Institution of, 11, Upper  
Belgrave Street, S.W.1. 5.55 p.m. A. G. Pugsley:  
*A Simple Theory of Suspension Bridges.*

FRI. 27 MAR. Electrical Engineers, Institution of, Savoy  
Place, W.C.2. 5.30 p.m. *Special Features of Courses in Electrical Engineering in the Royal Navy*  
(Discussion).

MON. 30 MAR. Electrical Engineers, Institution of, Savoy  
Place, W.C.2. 5.30 p.m. *Use and Abuse of Research*  
(Discussion).

TUES. 31 MAR. Manchester Geographical Society, 16, St.  
Mary's Parsonage, Manchester, 3. 6.30 p.m. N. G.  
Fisher: *The Caribbean.*

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